00093758

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THE FALL OF ICARUS.

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1864

ASTRA CASTRA

# EXPERIMENTS AND ADVENTURES

IN THE

# ATMOSPHERE.

93758

BY

HATTON TURNOR,

THE PRINCE CONSORT'S OWN

RIFLE BRIGADE.

LONDON:

CHAPMAN AND HALL, 193, PICCADILLY.

1865.

00093758

TO

THE LADY CAROLINE TURNOR,

AND

CHRISTOPHER TURNOR, Esq.,

IN GRATEFUL REMEMBRANCE OF

THEIR PARENTAL CARE

AND AFFECTIONATE TEACHING OF GOD'S WORD,

THIS VOLUME IS DEDICATED

BY THEIR SON,

CHRISTOPHER HATTON TURNOR.

" I CONCEIVE it to be the duty of every educated person closely to watch and study the time in which he lives, and, as far as in him lies, to add his humble mite of individual exertion to further the accomplishment of what he believes PROVIDENCE to have ordained."—SPEECH OF THE PRINCE CONSORT, *March 21st*, 1850.

"There are epochs in the history of every great operation and in the course of every undertaking, to which the co-operations of successive generations of men have contributed (especially such as have received their increments at various and remote periods of history), when it becomes desirable to pause for a while, and, as it were, to take stock; to review the progress made, and estimate the amount of work done: not so much for complacency, as for the purpose of forming a judgment of the efficiency of the methods resorted to, to do it; and to lead us to inquire how they may yet be improved, if such improvement be possible, to accelerate the furtherance of the object, or to ensure the ultimate perfection of its attainments. In scientific, no less than in material and social undertakings, such pauses and *résumés* are eminently useful, and are sometimes forced on our considerations by a conjuncture of circumstances which almost of necessity obliges us to take a *coup d'œil* of the whole subject, and make up our minds, not only as to the validity of what is done, but of the manner in which it has been done, the methods employed, and the direction in which we are henceforth to proceed, and probability of further progress."—SIR JOHN HERSCHEL.

# PREFACE.

THE Author has endeavoured in the following pages to do justice to the ubiquity and importance of a subject which must in some degree be of great interest to all, for the medium which forms its basis is the air, in which we all "live and move, and have our being."

Franklin said of the science of Aerostation, "*It is an infant, but it will grow.*" The discoveries and inventions relating to the uses which have hitherto been made of the atmosphere, and the mathematical deductions which so clearly teach us to hope for the practicability of aerial navigation, have never yet been described in a manner worthy of the human life hitherto sacrificed in unavailing attempts, nor of the confidence in ultimate success with which those are now inspired, who have patiently and laboriously considered the question in a mathematical and scientific point of view.

Beyond the outlines to be found in Encyclopædias, no general synopsis of the Science of Aerostation has hitherto been published in England, except Monck Mason's brief account in 1836; yet the number of English ascents and aeronauts more than doubles those of the French, who have had their experiments recorded by two historians since 1850. The present account, however, is not confined to England but wherever an adventure has occurred, or a courageous attempt has been made, it is here recorded.

The story extends over eighty years. In that time many pamphlets, letters, engravings, and caricatures have appeared in reference to this important subject. All the writers exhibit much ardour, many show acerbity; their productions have here been carefully collated and formed into a summary: if inaccuracies should have inadvertently arisen in the process, the Author will gladly see them corrected.

Public attention has been recently aroused from the lethargy of "hope deferred," by the experiments of Mr. Coxwell, one of the boldest pioneers of the science of aerostation; especially when, in the company of Mr. Glaisher, the eminent Meteorologist, he made an

ascent which was thus mentioned in a leading article of the *Times*, on the 11th of September, 1862:—

"It deserves to take its place among the unparalleled junctures, and the critical and striking moments of war, politics, or discovery;"

and again:—

"The courage of the men of science deserves to have a chapter of history devoted to it."

Aerostation may, indeed, be well considered as a branch of science, which displays, among other qualities, the largest amount of physical courage in its professors.

The Author has ventured to add this contribution to the History of Aerostation in the hope that his readers will observe how much the subject differs from other sciences in *the impossibility* of keeping it concealed from public observation during its progress into maturity, and *of forming it into a system before it engages popular attention* in an imperfect state; and this would appear to be one of the greatest difficulties with which it has to contend.

The Author trusts that when full publicity shall have been given to the comparative rarity of accidents, and the causes whence they have arisen, many persons may be induced to avail themselves of that enjoyment of Nature under novel aspects, from which they are now deterred by the apprehension of personal danger. Schiller says of Columbus—

With Genius, Nature ever stands in solemn union still,
And ever what the one foretels, the other shall fulfil.

May this prove true of the assertion that we *shall eventually* bring into useful subjection all the atmospheric currents, which for the present baffle our attempts to subdue or control them! If any means should hereafter be found for rendering the science of aerial navigation practically and generally useful, how apt would then be the following quotation from Milton:—

Th' invention all admir'd, and each, how he
To be th' inventor miss'd; so easy 't seem'd
Once found, which yet unfound most would have thought
Impossible!

— — —

NOTE.—*A discursive chapter has been added, on what Sir Bulwer Lytton defines as the "normal clairvoyance of poets' imagination;" and it will be found that it is a remarkable one, representing as it does the thoughts of so many ages and countries on one subject.*

WINCHESTER, *May* 1865.

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*The description of the Plates having been inadvertently omitted in this edition, the following list of them, with the pages opposite to which they are placed, may be in some degree a compensation for the oversight.*

*I have to return my thanks for the very kind assistance rendered to this work by Colonel Sir Henry James, R.E., F.R.S., and Captain Helsham Jones, R.E., to whom I am indebted for the success of this division of the book.*

No.

1 .. .. .. .. .. .. .. .. .. .. .. .. (*Frontispiece.*)

FALL OF ICARUS, A CAUTION TO AERONAUTS. THO' ICARUS FALLS, YET DÆDALUS FLIES.

1*a* .. .. .. .. .. .. .. .. .. .. .. *Facing page* 2

THE ARGONAUTS. [Nos. 1, 1*a*, 1*b*, 1*c*, 30*a* are from PICARD'S Illustrations in the 'TEMPLE OF THE MUSES,' 1730 A.D.]

Quorum simul alba Nautis
Stella refulsit,
Defluit saxis agitatus humor,
Concidunt venti, fugiuntque nubes,
Et minax (quod sic voluere) ponto
Unda recumbit.—*Horat.* 1, *Carm. Od.* 12.

1*b* .. .. .. .. .. .. .. .. .. .. .. *Facing page* 16

BELLEROPHON FIGHTS THE CHIMÆRA.

Τὴν μὲν Πήγασθ' εἷλε, καὶ ἐσθλὸς Βελλεροφόντης.

1*c* .. .. .. .. .. .. .. .. .. .. .. *Facing page* 10

PHAETON STRUCK DOWN BY JUPITER'S THUNDER.

Intonat, et dextrâ libratum fulmen ab aure
Misit in aurigam; pariterque animâque rotisque
Exuit, et sævis compescuit ignibus ignes.—*Ovid, Met.* 2.

2 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 28

HOMO VOLANS; xxxixth illustration in the work, MACHINÆ NOVÆ, Fausti Verantii Siceni cum declaratione. Latina, Italica, Hispanica, Gallica, et Germanica (Venetiis) (Consansir, 1695, in MS.)

Homme volant avecq un voile quarre estendu avecq quattre perches egalle et ayant attache quattre cords aux quattres coings, un homme sans danger se pourra jetter du haut d'une tour, ou de quelque aultre lieu eminent: Car encores que alheure il naye pas de vent, l'effort de celuy qui tombera, a portera du vent, qui retiendra la voile, de peur qu'il ne tombe violement, mais petit à petit descende; l'homme doncq se doiht mesurer avecq la grandeur de la voile.

3 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 34

BARCELONA, 1678. It was copied by the same artist and at the same time as the foregoing, but the reference having been lost, the original, which is certainly in the British Museum, cannot now be found.

4 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 44

REPRESENTATION of the AIR BALLOON of M. MONTGOLFIER, in the FIELD OF MARS near PARIS.

This Balloon of 38 feet in Circumference, made of Taffeta covered with Elastic Gum and filled with Inflammable Air drawn from Iron by means of Vitriolic Acid, rose of itself, the 27th August, 1783, at 5 o'clock in the evening, in Presence of more than 300,000 People.

5 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 56

GENERAL ALARM of the INHABITANTS of Gonesse, occasioned by the *Fall* of the *Air Balloon* of *Mr. Montgolfier.*

The Balloon previously described rose in heavy rain above the clouds; "It is presumed that it was carried to the height of more than 20,000 feet, when it burst by the reaction of the Inflammable Gas upon the Atmospheric Air; it fell at three-quarters past five near Gonesse, 10 miles from the Champ de Mars. The affrighted inhabitants ran together, and two Monks having assured them it was the skin of a Monstrous Animal, they attacked it with stones, pitch-forks, and flails, the Curate of the Village was obliged to attend in order to remove the fears of his astonished *Parishioners.* At last they tied to the Tail of a Horse the finest Instrument that was ever made for an Experiment in Natural Philosophy, and trailed it across the fields more than 6000 feet."

No.

6 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 72

A Monsieur de Faujas de St. Fond, de Plusieurs Académies.

Expérience Aérostatique faite à Versailles le 19 Septembre, 1783, en présence de leurs Majestés, de la Famille Royale, et de plus de 130 mille spectateurs, par Messrs. de Montgolfier, avec un Ballon de 57 pieds de hauteur, sur 41 de diamètre.

Cette superbe machine, a fond d'azur, avec le chiffre du Roi et divers ornements en couleur d'or, déplaçoit 37,500 pieds cubes d'air atmosphérique, pesant 3192 livres, mais la vapeur dont on la remplissoit, pesant moitié moins que l'air commun, il restoit une rupture déquilibre de 1596 livres sur quoi la machine et la cage où étoit un mouton, un coq et un canard, pesant ensemble 900, et ce poid devant être soustrait, le Ballon auroit pu enlever encore 696 livres. A une heure un coup de canon annonça qu'on alloit remplir la machine; onze minutes àprès, un second coup apprit quelle étoit pleine, et un troisième qu'elle alloit partir; elle s'éleva alors majestueusement à une grande hauteur, à la surprise des spectateurs et au bruit des acclamations publics. Elle se soutient quelque tems en équilibre et descendit lentement huit minutes après, à 1700 toises de distance du point de son départ, dans le bois de Vaucresson, Carrefour Maréchal; le mouton, le coq, et le canard n'éprouvèrent pas la plus légère incommodité.

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Illustrations of the same Experiment in the European Magazine.

8 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 104

Expérience de la Machine Aérostatique de M. Montgolfier, au Château de la Muette, le 21 Novembre, 1783.

Le Ciel étoit couvert en partie de nuages: à midi 8 min. on a annoncé en tirant une boëte, qu'on alloit remplir la Machine; 8 min. après, elle étoit prête à partir; M. le Marquis d'Arlandes et M. Pilâtre de Rozier se sont mis dans la galerie. On l'a d'abord laissé enlever par forme d'essai, en la soutenant avec des cordes, mais s'étant dirigée sur une des allées du Jardin, elle a souffert plusieurs déchirures qui ont été réparées en moins de 2 heures. A 1 heure 54 min. elle est partie, portant les mêmes personnes; étant environ 250 pieds de haut, ces MM. ont salué les spectateurs en baissant le chapeau. Ce spectacle était majestueux et attendrissant; la machine a monté à trois mille pieds environs. Tout Paris a pu la voir traversant la Seine et passant entre l'École Militaire et les Invalides; les voyageurs voulant borner leur course, ont laissé descendre la machine, mais le vent les dirigeant sur les maisons de la rue de Sèvres, Faub. St. Germ., ils se sont relevés pour traverser Paris; ensuite ils sont descendu tranquillement dans la campagne du nouveau Boulevard. En 25 minutes ils ont parcouru 2 lieues sans éprouver aucune incommodité. La machine a 70 pieds de haut, 46 de diamétre, contenant 6000 pieds cubes; elle est de toile de coton gommée; le poids qu'elle a enlevé est de 1700.

9 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 116

François Pilâtre de Rozier.

President of the Museum established at Paris in 1781 under the Patronage of Monsieur and Madame; Inspector of the Cabinet of Physick, Chymistry, and Natural History of Monsieur; Secretary of the Cabinets of Madame; Pensioner of the King; Member of several National and Foreign Academies, and an honorary Member of the Thornville or Balloon Club of London. From an Original Picture in the possession of Colonel Thornton (being the only Portrait he would ever permit to be painted) by whose desire it is engraved, to perpetuate the memory of that great man. François Pilâtre de Rozier, the First Aeronaut, was born at Metz on the 30th March, 1756. In 1782 he performed the experiment described in the Picture of inspiring and expiring inflammable air before the Royal Family at Paris, and repeated the same experiment in London on May 27th, 1785, before the Members of the Balloon Club. On the 14th of June, 1785, M. Pilâtre de Rozier, accompanied by M. de Romain, ascended with his Balloon from Boulogne with an intention to cross the Channel to England. At an elevation of 3600 feet the inflammable air took fire and exploded the Balloon, which descended with such an accelerated velocity as to crush the unfortunate adventurers.

No.

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GLOBE AEROSTATIQUE, dédié à Monsieur Charles.

Cette machine est representé ici s'élevant pour la seconde fois au milieu de la Prairie de Nesle, ou il venoit de descendre, accompagné de M. Robert et en présence de Mgr. le Duc de Chartres, M. le Duc de Fitz-James, et de M. Farer, Gentilhomme Anglois. M. Robert présente le Procès-Verbal à signer aux Curés d'Hédouville et de Nesle.

11 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 140

M. CHARLES, PROFESSOR OF NATURAL PHILOSOPHY.

12 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 160

THE ENTERPRISING LUNARDI'S GRAND AIR-BALLOON.

13 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 172

VINCENT LUNARDI, Secretary to the late Neapolitan Ambassador, First AERIAL TRAVELLER in England, an Honorary Member of the Honourable Artillery Company of the City of London, and Royal Archer of Scotland.

14 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 184

EXPÉRIENCE AÉROSTATIQUE faite à Lyon le 19 Janvier, 1784, à midi 48 minutes, avec un Ballon de 100 pieds de diamétre, sur 118 : de haut il s'est élevé à la hauteur de 1400 Toises, et a été vu de 12 lieues à la ronde ; et il a fait l'admiration de tous les spectateurs. Il a descendu dans une prairie, peu éloigné de son départ.

Lorsque, d'un front majestueux
Qu'embellissoit la modestie,
MONTGOLFIER s'éleva près du séjour des Dieux,
Il approchoit de sa patrie.

Voyageurs Aëriens :—M. Montgolfier, inventeur ; M. Pilastre du Rozier ; Le Prince Charles, fils du Prince de Ligne ; M. le Comte d'Anglefort, Lieut.-Col. d'Inf., Chevalier de S. Louis ; M. le Comte de Laurencin, Chevalier de S. Louis ; M. le Comte de Dampiere, Officier aux Gardes Français ; M. Fontaine, coopérateur zélé.

15 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 196

MACHINE AÉROSTATIQUE de cent vingt pieds de hauteur sur cent de diamétre, construite à Lyon, avec une enveloppe formée par trois papiers entre deux canevas, et un filet qui enveloppoit le tour et retenoit la gallérie ; sur la surface étoient représentés diverses alégories. Cette machine, faite sous la direction de M. de Montgolfier l'aîné en vertu d'une Souscription, s'est élevée le 19 Janvier, 1784, à près de deux mille cinq cent pieds de hauteur ; portant avec elle M. de Montgolfier l'ainé, M. Pilâtre de Rozier, M. Le Prince Charles De Ligne, M. le Comte de la Porte d'Anglefort, M. le Comte de Laurencin, M. le Comte de Dampiere, et M. Fontaine de Lyon, zélé coopérateur. Sa direction fut verticale et parvint à sa plus grande hauteur en 13 minutes de tems ; alors, s'étant fait une déchirement à l'enveloppe, cette machine resta un instant stationnaire, et descendit ensuite assez promptement dans une prairie aux environs de Lyon, sans qu'aucun des nouveaux argonautes eut éprouvé la moindre incommodité. Jamais scène ne fut plus touchante que l'accueil et les acclamations qui furent faites aux voyageurs, et surtout les embrassements réiterées du Prince de Ligne et de son Fils. Le soir, à la Comédie, il fut joué une Cantade à l'honneur de M. de Montgolfier, qui fut couronné, lui et ses compagnons de Voyage, dans la Loge de l'Intendance ; tous les habitans de la Ville de Lyon et plus de trente mille étrangers qui y étoient venus de toutes parts furent témoins de cette belle expérience.

This was an Engraving of the same event done at Paris.

16 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 210

LE NOUVEAU JEU DES BALLONS AÉROSTATIQUES À L'USAGE DES ESPRITS ÉLEVÉS.

*Combinaison.*—Ce Jeu, comme celui du Juif, s'exécute avec deux dez et les jettons, du prix desquels on convient : on en met chacun huit sur le No. 1, avant de commencer la partie ; que l'on paye ou que l'on reçoit suivant les régles inscrites au bas de chaque cas, et si l'on excède le nombre 13, on retrogradera d'autant de pointes.

No.

17 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 222

COUNT ZAMBECCARI'S BALLOON, 1785.

18 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 234

TOUR DE CALAIS.

Nouvelle Machine Aérostatique construite par Mr. Romain, par ordre du Gouvernement, destinée à faire le passage de France en Angleterre, conjointment avec M. Pilâtre de Rozier.

19 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 246

BLANCHARD'S 28TH FAHRT ZU NÜRNBERG, 1787.

20 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 254

LA MINERVE, an advertisement of Robertson's.

21 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 262

THE ASCENT OF MR. SADLER AND CAPTAIN PAGET FROM HACKNEY, AUGUST, 1811. From a drawing on the spot.

22 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 270

THE VILLAGE OF SEAL, NEAR SEVENOAKS, KENT, where, on the 23rd August, 1825, at 6 P.M., M. P. COMILLOT established the principle of sailing in an horizontal direction at any required point of elevation.

23 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 282

THE BATTLE OF FLEURUS.

24 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 312

THE FIRST CARRIAGE OF THE AERIAL TRANSIT COMPANY.

25 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 362

A BALLOON VIEW OF THE DERBY IN 1846.

26 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 398

AÉROSTATION OUT AT ELBOWS; OR, THE ITINERANT AERONAUT.

Behold a hero, comely, tall, and fair!
His only food phlogisticated air!
Now on the wings of mighty winds he rides!
Now torn thro' hedges!—dash'd in ocean's tides!

Now drooping roams about from town to town,
Collecting pence t' inflate his poor balloon;
Pity the wight, and something to him give,
To purchase gas to keep his frame alive.

27 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 412

NEW PRINCIPLES; OR, THE MARCH OF INVENTIONS: a Caricature of 1828.

28 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 434

THE CHAMBER OF GENIUS.

29 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 436

TRYING ENPERIMENTS.

30 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 444

THE GROWTH OF SCIENCES FROM ADAM AND EVE TO THE INVENTION OF THE BALLOON, 1783. [Frontispiece to the 1st edit. of the 'Encyclopedia Britannica.']

30*a* .. .. .. .. .. .. .. .. .. .. .. *Facing page* 480

ATLAS SUPPORTING THE HEAVENS ON HIS SHOULDERS.

. . . Lævaque a parte Medusæ
Ipse retro versus squalentia prodidit ora
Quantus erat, mons factus Atlas. . . .
Et omne
Cum tot sideribus cœlum requievit in illo.

*Ovid. Met.* 4.

# PORTRAITS.

No.

31 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 462

1. M. Le Marquis D'Arlandes. Premier Navigateur Aërien.
2. Duc de Chartres, father of "Louis Philippe."
3. M. Garnerin, the First to descend in a Parachute. This sketch was drawn by Edward Hawke Locker, on an aerial voyage in 1802.
4. Dr. Jefferies, an American who accompanied Blanchard in the first voyage across the Channel.

32 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 462

5. Jean Pierre Blanchard. The first Aerial *Mariner*, Citizen of Calais, and Pensioner of the French King, born at Andely in Normandy, the 4th July, 1753. In his sixth Aerial Voyage he crossed the Straits between Dover and Calais; he left Dover Castle on the 7th January, 1785, at one o'clock at noon, and descended at a quarter before three at Guignes in France, where a Pyramid is erected to his honour, and the place by the King's order is to be called "The Canton of Blanchard."
6. Mons. Charles. The inventor of the Gas Balloon.
7. Mr. Hampton.
8. Robert Cocking, who lost his life at Lee in Kent, by descending with his Parachute from the Nassau Balloon, 24th July, 1837.

33 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 462

9. Tiberius Cavallo, F.R.S., Author of the "History of Aerostation in 1785."
10. Mrs. Sage, the first English lady who made an aerial voyage.
11. Charles Green (who made 526 ascents without any serious accident, and is still living, aged 84 years).
12. Edward Spencer (who made many ascents with Mr. Green, and was with him on the occasion of Mr. Cocking's parachute experiment).

34 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 462

13. To the Right Honourable the Chancellor, the Rev. the Vice-Chancellor, the Rev. the Proctors, the Rev. the Heads of Colleges and Halls, with their respective Societies, this Engraving of Mr. Sadler (the first English aeronaut) is respectfully dedicated, etc., by James Roberts. Oxford, 1785.
14. The two Montgolfiers. Inventors of the Balloon.
15. James Glaisher, Esq., F.R.S., the meteorologist.
16. Henry Coxwell, Esq. (who has made 530 ascents).

35 .. .. .. .. .. .. .. .. .. .. .. *Facing page* 462

From left to right.

1. Walter Prideaux, Esq.
2. — Hollins, Esq., R.A.
3. W. M. James, Esq.
4. Robert Holland, Esq., M.P.
5. Monck Mason, Esq.
6. Charles Green, Esq.

} The Nassau Party in 1836.

# VIGNETTES.

The photograph is from a sepia drawing, copied from a wood engraving executed by Dalziel and designed by Mr. John Linton .. .. .. .. *Dedication page*

No.

1. Jupiter Tonans. Antique Greek gem in a cabinet at Turin, original size, from the Worsley gems .. *Title page*

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*It is a very pleasing duty to acknowledge my obligations for the designs of some of the Vignettes that illustrate this volume, to my friends, Miss Johns, Captain Archer, 60th Rifles, and Charles Fairfield, of P. C. O. Rifle Brigade.*

*Nos.* 3, 4, 5, *and* 47, *are the well-known designs of Kaulbach.*

*No.* 18 *is also a German design, by Bol.*

*Messrs. Dalziel engraved the larger half, and the others were executed by Mr. Whymper, Mr. Pearson, Mr. Petherwick, and M. Dumont, of Paris.*

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## CORRIGENDA.

Page 85 of Chapter IV., heading, *for* Louis Buonaparte, *read* Lucien Buonaparte.
„ 76, last line but 5, *for* Roberts *read* Robert.
„ 89, heading, *for* ROZIRE *read* ROZIER.
„ 159, under woodcut, *for* Garnarin *read* Garnerin.
„ 218, last line but 3, *for* Eberfeld *read* Elberfeld.
„ 219, line 27, *for* Mont Viso *read* Monte Viso.
„ „ line 35, „ „ „ „
„ 221, line 27, *for* trikceries *read* trickeries.
„ 227, line 1, "Australian," subsequently called "Australasian."
„ 269, last line but 3, *for* D'Arnoult *read* Arnould.
„ 276, line 17, *for* fablist *read* fabulist.
„ 338, line 19, *for* éviteur *read* éviter.
„ 338, last line but 11, *for* duxième *read* deuxième.
„ 354, last line but 3, *for* Aerien *read* aérien.
„ 391, line 3, *for* indifferent *read* indifférent.
„ „ line 3, *for* education *read* éducation.
„ „ line 20, *for* chimerique *read* chimérique.
„ „ line 20, *for* decouvert *read* découvert.
„ 392, line 14, *for* agreable *read* agréable.
„ „ line 15, *for* melodieuses *read* mélodieuses.
„ „ line 16, *for* generale *read* générale.
„ „ line 28, *for* pais *read* païs.
„ „ line 29, *for* notre *read* nostre.
„ „ line 40, *for* verité *read* vérité.
„ „ line 40, *for* Pedans *read* pédants.
„ „ line 42, *for* conte *read* compte.
„ „ line 42, *for* insenséz *read* insensés or insensez.
„ „ line 43, *for* repondit *read* répondit.
„ „ last line but 3, *for* retirerent *read* retirèrent.
„ 393, line 6, *for* reverence *read* révérence.
„ „ line 22, *for* mon masle a leurs, &c., *read* à leurs.
„ 394, line 6, *for* alleguay *read* alléguay.
„ „ line 7, *for* decouvrirent *read* découvrirent.
„ „ line 7, *for* me dirent ils *read* me dirent-ils.
„ „ line 13, *for* possedois *read* possédois.
„ „ line 15, *for* fouroient *read* fourroient.
„ „ line 26, *for* repartis de *read* repartis-de.
„ „ line 28, *for* siflé *read* sifflé.
„ „ line 28, *for* eclat *read* esclat.
„ „ line 37, *for* s'ecriat'il *read* s'écria-t-il.
„ 442, line 12, *for* étrangères *read* étrangère.
„ 459.—Year 1824, *for* Dupuis Delcourt *read* Depuis-Delcourt.
„ 1825, *for* Captain Currie *read* Curry.
„ 461.—Year 1836, *for* Captain Grenow *read* Gronow.
„ 462.—Year 1848, *for* Liege *read* Liége.
„ 463.—Year 1783. (Meusnier). Line 1, *for* Academie *read* Académie.
„ „ „ „ „ Line 2, *for* aérostatique *read* aérostatiques.
„ „ „ „ (M. Pingeron). *For* aerostatique *read* aérostatiques.
„ „ Year 1784. (M. de Bertholon). *For* retires *read* retirer.
„ „ „ „ (M. de Montgolfier). *For* académic *read* académie.
„ 464.—Year 1825. Depuis Delcourtr, *dele* final r.
„ „ „ „ *For* comte rendu *read* compte rendu.
„ „ Year 1851. (Jul. Turgan). *For* Histoires *read* Histoire.
„ „ Year 1863. (Dr. Pierre Moreaud). Line 2, *for* Aerostat *read* Aérostats.

## EXPLICANDA.

Page 23.—The M. Rozier here mentioned and M. Pilâtre de Rozier, whose name recurs so often, were different individuals.
„ 110.—Napoleon here mentioned is Napoleon I.

# ASTRA CASTRA.

## CHAPTER I.

### THE DAWN OF NAVIGATION COMPARED WITH THE DAWN OF AEROSTATION.

See him from Nature rising slow to art!
To copy instinct then was reason's part:
Thus then to man the voice of Nature spake—
Go, from the creatures thy instructions take:
Learn of the birds . . . . .
. . . . . .
. . . . . .
Learn of the little Nautilus to sail,
Spread the thin oar, and catch the driving gale.—POPE.

FROM the Bible we learn that the directions for building the first vessel were given by God himself. Much of the ridicule that Noah had to bear may perhaps have arisen from the complete novelty of his attempt.

David in the cvii. Psalm, and other passages, refers to this subject; but as the Apocrypha is less read, I will here give some verses from the book of the Wisdom of Solomon, which appear to me to express the same dread of the water that we now have of the air. The inspired author wished to draw attention to the folly of worshipping idols, and, in comparison, he speaks of ships, which are also the work of man's hands, and by which he is much more likely to be saved than by carved images:—

Chap. xiv. 1 to 5.—1. Again, one prepareth himself to sail, and about to pass through the raging waves, calleth upon a piece of wood more rotten than the vessel that carrieth him:

2. For verily desire of gain deviseth that, and the workman built it by his skill.

3. But thy providence, O Father, governeth it: for thou hast made a way in the sea, and a safe path in the waves—

4. Showing that thou canst save from all danger; *yea, though a man went to sea without art.*

5. Nevertheless thou wouldest not that the works of thy wisdom should be idle, and therefore do men commit their lives to a *small piece of wood, and passing through the rough sea in a weak vessel are saved.*

The classic poets impute the origin of navigation to Bacchus or Neptune; and Pindar thus speaks of the 'Argo:'—

Τὸν δὲ παμπειθῆ γλυκὺν ἡμιθέοι-
σιν πόθον γ' ἔνδαιεν Ἥρα
Ναὸς Ἀργοῦς· μή τινα λειπόμενον
Τὰν ἀκίνδυνον παρὰ ματρὶ μένειν
Αἰῶνα πέσσοντ', ἀλλ' ἐπὶ καὶ θανάτῳ
Φάρμακον κάλλιστον ἐᾶς ἀρετᾶς
Ἁλιξιν εὑρέσθαι σὺν ἄλλοις.
Ἐς δ' Ἰαωλκὸν ἐπεὶ
Κατέβα ναυτᾶν ἄωτος,
Λέξατο πάντας ἐπαι-
νήσαις Ἰάσων. καί ῥά οἱ
Μάντις ὀρνίχεσσι καὶ κλά-
ροισι θεοπροπέων ἱεροῖς
Μόψος ἄμβασε στρατὸν
Πρόφρων. ἐπεὶ δ' ἐμβόλου
Κρέμασαν ἀγκύρας ὕπερθεν
Χρυσέαν χείρεσσι λαβὼν φιάλαν
Ἀρχὸς ἐν πρύμνᾳ πατὴρ Οὐρανιδᾶν
Ἐγχεικέραυνον Ζῆνα, καὶ ὠκυπόρους
Κυμάτων ῥιπὰς ἀνέμων τ' ἐκάλει,
Νύκτας τε, καὶ πόντου κελεύθους,
Ἀματά τ' εὔφρονα, καὶ
Φιλίαν νόστοιο μοῖραν.
Ἐκ νεφέων δέ οἱ ἀντ-
άυσε βροντᾶς αἴσιον
Φθέγμα· λαμπραὶ δ' ἦλθον ἀκτῖ-
νες στεροπᾶς ἀπορηγνύμεναι.
Ἀμπνοὰν δ' ἥρωες ἔ-
στασαν θεοῦ σάμασι
Πιθόμενοι. κάρυξέ δ' αὐτοῖς.

4TH PYTHIAN, 327th line.

Great Juno waked the sweet desire
Which bade the demigods aspire
With Argo o'er the deep to roam;
That fixed in his maternal home
Remote from peril none should stay,
And wear his laggard age away.
But share his fellow heroes' toil,
Death's fairest antidote, the spoil.
Soon as to proud Iolcos' town
Came the bright flower of seamen down,
Jason extoll'd with praises due,
And number'd all the valiant crew.
Skill'd in each bird that cleaves the sky,
And sacred lots of augury,
Mopsus enjoin'd the host their sail
To spread before the favouring gale.
But when they hang'd upon the prow
Their anchors o'er the deep below,
Fix'd at the stern, the chief displays
His sacred phial's golden blaze.
Invoking heaven's great father Jove,
Who wields his lightning spear above;
Waves that o'er ocean's bosom play,
And breezes' every-varying way,
Calm nights and days his prayers implore,
And sweet return, their wanderings o'er.
Propitious thunder's awful sound
Heaven's favouring answer quickly spoke,
And lightning's forked darts around
From all the clouds irradiate broke.
Elated at the prosperous sign,
The heroes glow with joy divine.
The augur issued his command
To ply their oars with constant force,
Suggesting to the valiant band
Sweet hopes to cheer them on their course.
Quick gaining with the breezy south
Th' inhospitable ocean's mouth,
There to the god a shrine they rear,
Who sways the raging sea's career.

—WHEELWRIGHT'S *Trans.*

Horace also says:—

Illi robur et æs triplex
Circa pectus erat; qui fragilem truci
Commisit pelago ratem
Primus.

The classic historians ascribe the discovery to the Phœnicians, or to the inhabitants of that "Ultima Thule, Britannica," whose coracle, like the one here represented, is still to be found on the coast of Donegal.

Each alteration has progressed with slow and painful steps* in this science, from these

* John Charnock, F.S.A., in his History of Marine Architecture, 1800, divides the improvements in this science into seven epochs:—"The 6th commences with the invention of the mariner's compass, A.D. 1260, and continues till the beginning of the 16th century, when the general introduction and use of cannon on board ships, together with the contrivance of port-holes, gave birth to the 7th and last epoch, by attaching to vessels those requisites and properties, which, though imperfectly supplied and provided for in the beginning, have, by repeated practice and continued experience, gradually improved into that excellence, and almost unimprovable state of perfection, which the ships built at the present day are by some supposed to possess."

In the Cotton MSS. are the heads of an intended publication on this subject in Sir Walter Raleigh's handwriting.

For a declaration of the impracticability of applying steam to marine navigation, see Dr. Lardner's Cabinet Cyclopædia 'Hydrostatics,' chap. ix. I quote this in a future chapter.

*The Dioscuri, or Castor and Pollux, the Guardians of Mariners*

rough shells of boats to the highly-finished, swift, and powerful vessels that we now possess.

Yet the difficulties at the commencement of Aerostation were plainly far greater; for whereas man had wood at hand that floated on water, he had to seek for means whereby to rise in the unseen ocean with which he is surrounded.

It took centuries of experiments, assisted by many accidental discoveries, to find out the properties of air.

The victory obtained as yet, has been only the power of visiting the atmosphere; but to master its currents, and guide one's self through them, is reserved for this or some succeeding generation.

We may hope from the present rapid means of communication, that the combined labours of many may effect in a few years improvements in Aerostation as marked as those which have been secured to marine navigation after a lapse of centuries.

Our hopes are further strengthened by the incredible progress made within a short period from the first steamer launched on the Clyde, to our beautiful fleets that now visit all the harbours of the world.

THE CORACLE OF THE BRITONS.

Bjoꝺ Eꞁꞁe aꝺ ċꞁꞁṁꞁe ꝺo ʒꞁaꝺ.

# CHAPTER II.

## ΑΝΑΒΑΔΗΝ; OR, THE "NORMAL CLAIRVOYANCE" OF POETS' IMAGINATION; AND THE EXPERIMENTS PRECEDING 1783.

Thought suggests experiment, experiment ministers fresh materials to thought.
—Sir Henry Holland, *Edinburgh Review.*

POETRY AND SCIENCE — OLYMPUS — THE "ETHEREAL PLAIN" — PHAETON — DÆDALUS AND ICARUS — ASTOLPHO, THE ENGLISH KNIGHT — "THE SOURCE OF THE NILE" — THE WIZARD ISMENE — GODFREY'S DREAM — ARMIDA — LATIN AUTHORS OF THE MIDDLE AGES — ROGER BACON ON FLYING — WILKINS, BISHOP OF CHESTER — KAI KAIOS, KING OF PERSIA — ENGLISH MONK ELMERUS — BORELLI'S 'DE MOTU ANIMALIUM' — THE JESUIT FATHER LANA'S PROPOSITIONS.

Buckle, in his 'History of Civilisation,' makes the following remarks on the consequences of divorcing poetry from science:—

In England, especially, there is, among physical inquirers, an avowed determination to separate philosophy from poetry, and to look upon them, not only as different, but as hostile. Among that class of thinkers, whose zeal and ability are beyond all praise, and to whom we owe most unbounded obligations, there does undoubtedly exist a very strong opinion, that, in their own pursuit, the imagination is extremely dangerous, as leading to speculations, of which the basis is not yet assured, and generating a desire to catch too eagerly at distant glimpses before the intermediate ground has been traversed. That the imagination has this tendency is undeniable. But they who object to it on this account, and who would, therefore, divorce poetry from philosophy, have, I apprehend, taken a too limited view of the functions of the human mind, and of the manner in which truth is obtained. There is, in poetry, a divine and prophetic power, and an insight into the turn and aspect of things, which, if properly used, would make it the ally of science instead of the enemy. By the poet, nature is contemplated on the side of the emotions; by the man of science, on the side of the understanding. But the emotions are as much a part of us as the understanding; they are as truthful; they are as likely to be right. Though their view is different, it is not capricious. They obey fixed laws; they follow an orderly and uniform course; they run in sequences; they have their logic and method of inference. Poetry, therefore, is a part of philosophy, simply because the emotions are a part of the mind. If the man of science despises their teaching, so much the worse for him. He has only half his weapons; his arsenal is unfilled. Conquests, indeed, he may make, because his native strength may compensate for the defects of his equipment. But his success would be more complete and more rapid, if he were properly furnished and made ready for the battle. And I cannot but regard as the worst intellectual symptom of this great country, what I must venture to call the imperfect education of physical philosophers, as exhibited both in their writings and in their trains of thought. This is the more serious, because they, as a body, form the most important class in England, whether we look at their ability, or at the benefits we have received from them, or at the influence they are exercising, and are likely to exercise, over the progress of society. It cannot, however, be concealed, that they display an ignorant respect for experiments, an undue love for minute detail, and a disposition to overrate the inventors of new instruments, and the discoverers of new but almost insignificant facts. Their predecessors of the seventeenth century, by using hypotheses more boldly, and by indulging their imagination more frequently, did certainly effect greater things, in comparison with the then state of knowledge, than our contemporaries, with much superior resources, have been able to achieve. The magnificent generalisations of Newton and Harvey could never have been completed in an age absorbed in one unvarying round of experiments and observations. We are in that predicament, that our facts have outstripped our knowledge, and are now encumbering its march. The publications of our scientific institutions, and of our scientific authors, overflow with minute and countless details, which perplex the judgment, and which no memory can retain. In vain do we demand that they should be generalised and reduced into order. Instead of that, the heap continues to swell. We want ideas, and we get more facts. We hear constantly of what nature is doing, but we rarely hear of what man is thinking. Owing to the indefatigable industry of this and the preceding century, we are in possession of a huge and incoherent mass of observations, which have been stored up with great care, but which, until they are connected by some presiding idea, will be

utterly useless. The most effective way of turning them to account, would be to give more scope to the imagination, and *incorporate the spirit of poetry with the spirit of science.* By this means our philosophers would double their resources, instead of working, as now, maimed, with only half their nature. They fear the imagination, on account of its tendency to form hasty theories. But surely all our faculties are needed in the pursuit of truth, and we cannot be justified in discrediting any part of the human mind. And I can hardly doubt that one of the reasons why we, in England, made such wonderful discoveries during the seventeenth century, was because that century was also the great age of English poetry. The two mightiest intellects our country has produced are Shakspeare and Newton; and that Shakspeare should have preceded Newton was, I believe, no casual or unmeaning event. Shakspeare and the poets sowed the seed, which Newton and the philosophers reaped.

This idealism has been further extolled by the powerful pen of Schiller, that gave birth to the beautiful designs of Kaulbach, of which the following are engravings. They remind us how the ideas of omnipresence and of aspiration naturally associate themselves with the atmosphere.

SCULPTURE.

Die von dem Thon, dem Stein bescheiden aufgestiegen,
Die schöpferische kunst, umschlieszt mit stillen Siegen
Des Geistes unermessnes Reich.
Was in des Wissens Land Entdecker nur ersiegen,
Entdecken sie, ersiegen sie für euch.
Der Schätze, die der Denker aufgehäufet,
Wird er in euren Armen erst sich freun,
Wenn seine Wissenschaft, der Schönheit zugereifet,
Zum Kunstwerk wird geadelt seyn—
Wenn er auf einen Hügel mit euch steiget,
Und seinem Auge sich, in mildem Abendschein,
Das malerische Thal—auf einmal zeiget.
Je reicher ihr den schnellen Blick vergnüget,
Je höhre, schönre Ordnungen der Geist
In einem Zauberbund durchflieget,
In einem schwelgenden Genusz umkreist;
Je weiter sich Gedanken und Gefühle
Dem üppigeren Harmonienspiele,
Dem reichern Strom der Schönheit aufgethan—
Je schönre Glieder aus dem Weltenplan,
Die jetzt verstümmelt seine Schöpfung schänden,
Sieht er die hohen Formen dann vollenden,
Je schönre Räthsel treten aus der Nacht,
Je reicher wird die Welt, die er umschlieszet,
Je breiter strömt das Meer, mit dem er flieszet,
Je schwächer wird des Schicksals blinde Macht,
Je höher streben seine Triebe,
Je kleiner wird er selbst, je grösser seine Liebe.

If Art rose plastic from the stone and clay,
To Mind from Matter ever sweeps its sway;
Silent, but conquering in its silence, lo,
How o'er the Spiritual World its triumphs go!
What in the Land of Knowledge, wide and far,
Keen Science tracks—for *you* discovered are:
First in your arms the wise their wisdom learn—
They dig the mine you teach them to discern;
And when that wisdom ripens to the flower
And crowning time of Beauty—to the Power
From whence it rose, new stores it must impart,
The toils of Science swell the Wealth of Art.
When to one height the Sage ascends with you,
As spreads the vale of matter round his view
In the mild twilight of serene repose;—
The more the Artist charms, the more the Thinker knows.
The more the shapes, in intellectual joy,
Link'd by the Genii which your spells employ,
The more the thought with the emotion blends—
The more up-buoyed by both the Soul ascends
To loftier Harmonies, and heavenlier things,
And tracks the stream of Beauty to its springs.
The lovely members of the mighty whole,
Till then confused and shapeless to his soul,
Distinct and glorious grow upon his sight,
The fair enigmas brighten from the Night,
More rich the Universe his thoughts enclose—
More wide the Ocean with whose wave he flows;
The wrath of Fate grows feebler to his fears,
As from God's Scheme Chance wanes and disappears;
And as each straining impulse soars above—
How his pride lessens—how augments his love!

PAINTING.

Wenn auf des Denkens freigegebnen Bahnen
Der Forscher jetzt mit kühnem Glücke schweift
Und, trunken von siegrufenden Päanen,
Mit rascher Hand schon nach der Krone greift;
Wenn er mit niederm Söldnerslohne
Den edlen Führer zu entlassen glaubt,
Und neben dem geträumten Throne
Der Kunst den ersten Sklavenplatz erlaubt:
Verzeiht ihm—der Vollendung Krone
Schwebt glänzend über eurem Haupt.
Mit euch, des Frühlings erster Pflanze,
Begann die seelenbildende Natur;
Mit euch, dem freud'gen Erntekranze,
Schlieszt die vollende Natur.

If on the course of Thought, now barrier-free,
Sweeps the glad search of bold Philosophy;
And with self-pæans, and a vain renown,
Would claim the praise and arrogate the crown,
Holding but as a soldier in her band,
The nobler Art that did in truth command;
And grants, beneath her visionary throne,
To Art, her Queen—the slave's first rank alone;—
Pardon the vaunt!—For You, Perfection all
Her star-gems weaves in one bright coronal!
With you, the first blooms of the Spring, began
Awakening Nature in the Soul of Man!
With you fulfill'd when Nature seeks repose,
Autumn's exulting harvests ripely close.

ARCHITECTURE.*

So führt ihn, in verborgnem Lauf,
Durch immer reinre Formen, reinre Töne,
Durch immer höhre Höhn und immer schönre Schöne
Der Dichtung Blumenleiter still hinauf—
Zuletzt, am reifen Ziel der Zeiten,
Noch eine glückliche Begeisterung,
Des jüngsten Menschenalters Dichterschwung,
Und—in der Wahrheit Arme wird er gleiten.

—SCHILLER.

So, scattering blooms, the still Guide, Poetry
Leads him thro' paths, tho' hid, that mount on high—
Thro' forms and tones more pure and more sublime—
Alp upon Alp of Beauty—till the time
When what we long in Poetry have nurst,
Shall as a God's swift inspiration burst,
And flash in glory, on that youngest day—
One with the Truth to which it wings the way!—

—SIR E. BULWER LYTTON.

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* Not having been able to obtain Poetry when desired, I have been obliged to substitute Architecture, a design by the same artist.

וַיִּרְכַּב עַל־כְּרוּב וַיָּעָף וַיֵּדֶא עַל־כַּנְפֵי רוּחַ

—PSALM XVIII. 11 *Hebrew Bible*, ver. 10 *in English Bible*.

On Cherubim and Seraphim
Full royally he rode,
And on the wings of flaming winds
Came flying all abroad.

—PSALM XVIII., *Sternhold and Hopkins's Metrical Version.*

Nothing can surpass the grandeur of this, even if compared with other passages of David's inspired writing. But let us descend to the loftiest fancy of the classic poets, and hear Homer in one of his descriptive scenes, that throw such beauty on the glowing mythology of Greece (*Iliad*; Book V. 925th line):—

Swift at the scourge, the ethereal coursers fly,
While the smooth chariot cuts the liquid sky.
Heaven's gates spontaneous open to the powers,
Heaven's golden gates, kept by the winged Hours;
Commission'd in alternate watch they stand,
The sun's bright portals and the skies command,
Involve in clouds the eternal gates of day,
Or the dark barrier roll with ease away.
The sounding hinges ring: on either side
The gloomy volumes, pierced with light, divide.
The chariot mounts, where deep in ambient skies,
Confused, Olympus' hundred heads arise;
Where far apart the Thunderer fills his throne;
O'er all the gods superior and alone.
There with her snowy hand the queen restrains
The fiery steeds, and thus to Jove complains;
* * * * *
To whom assenting, thus the Thunderer said:
"Go! and the great Minerva be thy aid;
To tame the monster-god Minerva knows,
And oft afflicts his brutal breast with woes."
He said: Saturnia, ardent to obey,
Lash'd her white steeds along the aerial way.
Swift down the steep of Heaven the chariot rolls,
Between the expanded earth and starry poles.
Far as a shepherd, from some point on high,
O'er the wide main extends his boundless eye;
Through such a space of air, with thund'ring sound
At every leap, the immortal coursers bound:
Troy now they reach'd, and touch'd those banks divine
Where silver Simois and Scamander join.
There Juno stopp'd, and her fair steeds unloosed,
Of air condensed a vapour circumfused;
For these, impregnate with celestial dew,
On Simois' brink ambrosial herbage grew.
Thence to relieve the fainting Argive throng,
Smooth as the sailing doves they glide along.—POPE.

---

Oh that I could as smoke arise,
That rolls its black wreaths through the air;
Mix with the clouds, that o'er the skies
Show their light forms, and disappear:
Or like the dust be toss'd
By ev'ry sportive wind, till all be lost!

—ÆSCHYLUS, *The Suppliant's Chorus*, 806th line.

And again (824th line):—

Oh might I sit sublime in air,
Where watery clouds the freezing snows prepare!

Again, in Pindar, who thus expresses the idea that pervades the Greek mythology (14th Olympiad, 14th line). It may be translated according to an old version:—

ἀλλὰ πάντων
Ταμίαι ἔργων ἐν οὐρανῷ
Χρυσότοξον θέμεναι
Παρὰ πύθιον Ἀπόλλωνα θρόνους,
Ἀέναον σέβοντι πατρὸς
Ὀλυμπιοιο τιμάν.

Ever on the ethereal plain
In harmonious measures move
The celestial choirs above.

THE ETHEREAL PLAIN.

An Italian painter of the fifteenth or sixteenth century, has well expressed this with his pencil, which the engraving here represents.

Euripides, also, in the Iphigenia :—

| | |
|---|---|
| Λαμπρὸν ἱππόδρομον βαίην, | Oh! might I travel through yon lucid road, |
| Ἐνθ' εὐάλιον ἔρχεται πῦρ. | Where rolls the chariot of the fiery God; |
| Οἴκειων δ' ὑπὲρ θαλάμων | Might I through th' impassive air |
| Πτέρυγας ἐν νώτοις ἀμοῖς | My unwearied course pursue! |
| Λήξαιμι θοάζουσα· | Till, distinguished from afar, |
| Εὐριπίδου, | My dear country rose to view: |
| Ἰφιγενειὰ ἡ ἐν Ταύροις, 1140. | Then quick descending from my airy height, |
| | My pinions would I close, and stay my flight. |

Enough having been given of the mind of Greece, let us turn to that of Rome, and take first Ovid's description of Phaëton :—

## STORY OF PHAETON.—Translated by Addison.

Interea volucres Pyroeis, Eous, et Æthon,
Solis equi, quartusque Phlegon, hinnitibus auras
Flammiferis implent, pedibusque repagula pulsant.
Quæ postquam Tethys, fatorum ignara nepotis,
Reppulit, et facta est immensi copia mundi;
Corripuere viam, pedibusque per aera motis
Obstantes findunt nebulas, pennisque levati
Prætereunt ortos isdem de partibus Euros.
Sed leve pondus erat, nec quod cognoscere possent
Solis equi: solitaque jugum gravitate carebat.
Utque labant curvæ justo sine pondere naves,
Perque mare, instabiles nimis levitate, feruntur;
Sic onere assueto vacuos dat in aera saltus,
Succutiturque alte, similisque est currus inani.
Quod simul ac sensere, ruunt, tritumque relinquunt
Quadrijugi spatium, nec, quo prius, ordine currunt.
Ipse pavet; nec qua commissas flectat habenas,
Nec scit, qua sit iter: nec, si sciat, imperet illis.
Tum primum radiis gelidi caluere Triones,
Et vetito frustra tentarunt æquore tingi.
Quæque polo posita est glaciali proxima Serpens,
Frigore pigra prius, nec formidabilis ulli,
Incaluit, sumsitque novas fervoribus iras.
Te quoque turbatum memorant fugisse, Boote,
Quamvis tardus eras, et te tua plaustra tenebant.
Ut vero summo despexit ab æthere terras
Infelix Phaethon, penitus penitusque jacentes;
Palluit, et subito genua intremuere timore:
Suntque oculis tenebræ per tantum lumen obortæ.
Et jam mallet equos nunquam tetigisse paternos:
Jamque agnosse genus piget, et valuisse rogando:
Jam Meropis dici cupiens; ita fertur, ut acta
Præcipiti pinus Borea, cui victa remisit
Frena suus rector, quam Dis votisque reliquit.
Quid faciat? multum cœli post terga relictum:
Ante oculos plus est; animo metitur utrumque.
Et modo, quos illi fato contingere non est,
Prospicit occasus: interdum respicit ortus.
Quidque agat ignarus, stupet: et nec frena remittit,
Nec retinere valet: nec nomina novit equorum.
Sparsa quoque in vario passim miracula cœlo,
Vastarumque videt trepidus simulacra ferarum.
Est locus, in geminos ubi brachia concavat arcus
Scorpios, et cauda flexisque utrimque lacertis
Porrigit in spatium signorum membra duorum.
Hunc puer ut nigri madidum sudore veneni
Vulnera curvata minitantem cuspide vidit;
Mentis inops, gelida formidine lora remisit.
Quæ postquam summum tetigere jacentia tergum,
Exspatiantur equi: nulloque inhibente per auras
Ignotæ regionis eunt, quaque impetus egit,
Hac sine lege ruunt: altoque sub æthere fixis
Incursant stellis, rapiuntque per avia currum.
Et modo summa petunt, modo per decliva, viasque
Præcipites spatio terræ propiore feruntur.
Inferiusque suis fraternos currere Luna
Admiratur equos: ambustaque nubila fumant.
Corripitur flammis, ut quæque altissima, tellus,
Fissaque agit rimas, et succis aret ademtis.
Pabula canescunt: cum frondibus uritur arbos:
Materiamque suo præbet seges arida damno.
Parva queror; magnæ pereunt cum mœnibus urbes:

Meanwhile the restless horses neigh'd aloud,
Breathing out fire, and pawing where they stood.
Tethys, not knowing what had pass'd, gave way,
And all the waste of heaven before them lay.
They spring together out, and swiftly bear
The flying youth through clouds and yielding air;
With wingy speed outstrip the eastern wind,
And leave the breezes of the moon behind.
The youth was light, nor could he fill the seat,
Or poise the chariot with its wonted weight:
But as at sea the unballasted vessel rides,
Cast to and fro, the sport of winds and tides,
So in the bounding chariot, toss'd on high,
The youth is hurried headlong through the sky.
Soon as the steeds perceive it, they forsake
Their stated course, and leave the beaten track.
The youth was in a maze, nor did he know
Which way to turn the reins, or where to go;
Nor would the horses, had he known, obey.
Then the seven stars first felt Apollo's ray,
And wish'd to dip in the forbidden sea.
The folded serpent, next the frozen pole,
Stiff and benumb'd before, began to roll,
And raged with inward heat, and threaten'd war,
And shot a redder light from every star;
Nay, and 'tis said, Bootes, too, that fain
Thou wouldst have fled, though cumber'd with thy wain.
The unhappy youth then, bending down his head,
Saw earth and ocean far beneath him spread.
His colour changed, he startled at the sight,
And his eyes darken'd by too great a light.
Now could he wish the fiery steeds untried,
His birth obscure, and his request denied;
Now would he Merops for his father own,
And quit his boasted kindred to the Sun.
So fares the pilot, when his ship is toss'd
In troubled seas, and all its steerage lost;
He gives her to the winds, and in despair
Seeks his last refuge in the gods and prayer.
What could he do? his eyes, if backward cast,
Find a long path he had already pass'd;
If forward, still a longer path they find:
Both he compares, and measures in his mind;
And sometimes casts an eye upon the east,
And sometimes looks upon the forbidden west.
The horses' names he knows not in the fright;
Nor would he loose the reins, nor could he hold them right.
Now all the horrors of the heavens he spies,
And monstrous shadows of prodigious size;
That, deck'd with stars, lie scattered o'er the skies.
There is a place above, where Scorpio bent
In tail and arms surrounds a vast extent;
In a wide circuit of the heavens he shines,
And fills the space of two celestial signs.
Soon as the youth beheld him, vex'd with heat
Brandish his sting, and in his poison sweat,
Half dead with sudden fear, he dropp'd the reins;
The horses felt them loose upon their manes,
And, flying out through all the plains above,
Ran, uncontroll'd, where'er their fury drove;
Rush'd on the stars, and, through a pathless way
Of unknown regions, hurried on the day.

Cumque suis totas populis incendia gentes
In cinerem vertunt. Sylvæ cum montibus ardent:
Ardet Athos, Taurusque Cilix, et Tmolus, et Œte:
Et nunc sicca, prius celeberrima fontibus, Ide:
Virgineusque Helicon, et nondum Œagrius Hæmos.
Ardet in immensum geminatis ignibus Ætne:
Parnassusque biceps, et Eryx, et Cynthus, et Othrys,
Et tandem Rhodope nivibus caritura, Mimasque,
Dindymaque, et Mycale, natusque ad sacra Cithæron.
Nec prosunt Scythiæ sua frigora: Caucasus ardet,
Ossaque cum Pindo, majorque ambobus Olympus:
Aeriæque Alpes, et nubifer Apenninus.
Tunc vero Phaethon cunctis e partibus orbem
Adspicit accensum, nec tantos sustinet æstus:
Ferventesque auras, velut e fornace profunda,
Ore trahit, currusque suos candescere sentit.
Et neque jam cineres ejectatamque favillam
Ferre potest: calidoque involvitur undique fumo.
Quoque eat, aut ubi sit, picea caligine tectus,
Nescit; et arbitrio volucrum raptatur equorum.
Sanguine tum credunt in corpora summa vocato,
Æthiopum populos nigrum traxisse colorem.
Tum facta est Libye, raptis humoribus æstu,
Arida: tum Nymphæ passis fontesque, lacusque
Deflevere comis. Quærit Bœotia Dircen,
Argos Amymonen, Ephyre Pirenidas undas.
Nec sortita loco distantes flumina ripas
Tuta manent: mediis Tanais fumavit in undis,
Peneosque senex, Teuthranteusque Caicus,
Et celer Ismenos, cum Phocaico Erymantho,
Arsurusque iterum Xanthus, flavusque Lycormas,
Quique recurvatis ludit Mæandros in undis:
Mygdoniusque Melas, et Tænarius Eurotas.
Arsit et Euphrates Babylonius, arsit Orontes,
Thermodonque citus, Gangesque, et Phasis, et Ister.
Æstuat Alpheos: ripæ Spercheides ardent:
Quodque suo Tagus amne vehit, fluit ignibus aurum.
Et, quæ Mæonias celebrarant carmine ripas,
Flumineæ volucres medio caluere Caystro.
Nilus in extremum fugit perterritus orbem,
Occuluitque caput, quod adhuc latet. Ostia septem
Pulverulenta vacant, septem sine flumine valles.
Fors eadem Ismarios Hebrum cum Strymone siccat,
Hesperiosque amnes, Rhenum, Rhodanumque, Padumque,
Cuique fuit rerum promissa potentia, Tibrin.
Dissilit omne solum; penetratque in Tartara rimis
Lumen, et infernum terret cum conjuge regem.
Et mare contrahitur: siccreque est campus arenæ,
Quod modo pontus erat: quosque altum texerat æquor,
Exsistunt montes, et sparsas Cycladas augent.
Ima petunt pisces: nec se super æquora curvi
Tollere consuetas audent delphines in auras.
Corpora phocarum summo resupina profundo
Exanimata jacent. Ipsum quoque Nerea fama est,
Doridaque, et natas, tepidis latuisse sub antris.
Ter Neptunus aquis cum torvo brachia vultu
Exserere ausus erat: ter non tulit aeris æstus.
Alma tamen Tellus, ut erat circumdata ponto,
Inter aquas pelagi, contractosque undique fontes,
Qui se condiderant in opacæ viscera matris;
Sustulit omniferos collo tenus arida vultus,
Opposuitque manum fronti: magnoque tremore
Omnia concutiens paullum subsedit, et infra,
Quam solet esse, fuit: siccaque ita voce locuta est:
Si placet hoc, meruique, quid o tua fulmina cessant,

And now above, and now below they flew,
And near the earth the burning chariot drew.
The clouds disperse in fumes, the wond'ring moon
Beholds her brother's steeds beneath her own:
The high lands smoke, cleft by the piercing rays;
Or, clad with woods, in their own fuel blaze.
Next o'er the plains, where ripen'd harvests grow,
The running conflagration spreads below.
But these are trivial ills: whole cities burn,
And peopled kingdoms into ashes turn.
The mountains kindle as the car draws near;
Athos and Tmolus red with fires appear;
Ægagrian Hæmus (then a single name)
And virgin Helicon increase the flame:
Taurus and Œte glare amid the sky;
And Ida, spite of all her fountains, dry:
Erix, and Othrys, and Cithæron, glow;
And Rhodope, no longer clothed in snow:
High Pindus, Mimas, and Parnassus, sweat;
And Ætna rages with redoubled heat:
Ev'n Scythia, through her hoary regions warm'd,
In vain with all her native frost was arm'd:
Cover'd with flames, the towering Apennine,
And Caucasus, and proud Olympus, shine;
And where the long-extended Alps aspire
Now stands a huge continued range of fire.
The astonish'd youth, where'er his eyes could turn,
Beheld the universe around him burn:
The world was in a blaze; nor could he bear
The sultry vapours and the scorching air,
Which from below, as from a furnace, flow'd:
And now the axle-tree beneath him glow'd.
Lost in the whirling clouds that round him broke,
And white with ashes, hovering in the smoke,
He flew where'er the horses drove, nor knew
Whither the horses drove, or where he flew.
'Twas then, they say, the swarthy Moor began
To change his hue, and blacken in the sun;
Then Libya first, of all her moisture drain'd,
Became a barren waste, a wild of sand;
The water-nymphs lament their empty urns;
Bœotia, robb'd of silver Dirce, mourns;
Corinth Pyrene's wasted spring bewails;
And Argos grieves whilst Amymone fails.
The floods are drain'd from every distant coast:
Ev'n Tanais, though fix'd in ice, was lost;
Enraged Caicus and Lycormas roar,
And Xanthus, fated to be burnt once more:
The famed Mæander, that unwearied strays
Through mazy windings, smokes in every maze:
From his beloved Babylon Euphrates flies:
The big-swoln Ganges and the Danube rise
In thick'ning fumes, and darken half the skies:
In flames Ismenos and the Phasis roll'd,
And Tagus, floating in his melted gold:
The swans, that on Cayster often tried
Their tuneful songs, now sung their last, and died:
The frighted Nile ran off, and underground
Conceal'd his head, nor can it yet be found;
His seven divided currents all are dry,
And where they roll'd seven gaping trenches lie:
No more the Rhine or Rhone their course maintain,
Nor Tiber, of his promised empire vain.
The ground, deep cleft, admits the dazzling ray,
And startles Pluto with the flush of day:

*Phaëton struck down by Jupiter's thunder.*

Summe deûm? liceat perituræ viribus ignis,
Igne perire tuo, clademque auctore levare.
Vix equidem fauces hæc ipsa in verba resolvo;
(Presserat ora vapor;) tostos en adspice crines,
Inque oculis tantum, tantum super ora favillæ.
Hosne mihi fructus, hunc fertilitatis honorem
Officiique refers; quod adunci vulnera aratri,
Rastrorumque fero, totoque exerceor anno?
Quod pecori frondes, alimentaque mitia fruges
Humano generi, vobis quod thura ministro?
Sed tamen exitium fac me meruisse: quid undæ,
Quid meruit frater? cur illi trâdita sorte
Æquora decrescunt, et ab æthere longius absunt?
Quod si nec fratris, nec te mea gratia tangit;
At cœli miserere tui. Circumspice utrumque;
Fumat uterque polus: quos si vitiaverit ignis,
Atria vestra ruent. Atlas en ipse laborat,
Vixque suis humeris candentem sustinet axem.
Si freta, si terræ pereunt, si regia cœli;
In chaos antiquum confundimur. Eripe flammis,
Si quid adhuc superest: et rerum consule summæ.
Dixerat hæc Tellus: neque enim tolerare vaporem
Ulterius potuit, nec dicere plura: suumque
Rettulit os in se, propioraque manibus antra.
  At pater omnipotens superos testatus, et ipsum,
Qui dederat currus, nisi opem ferat, omnia fato
Interitura gravi; summam petit arduus arcem,
Unde solet latis nubes inducere terris:
Unde movet tonitrus, vibrataque fulmina jactat.
Sed neque, quas posset terris inducere, nubes
Tunc habuit, nec, quos cœlo dimitteret, imbres.
Intonat: et dextra libratum fulmen ab aure
Misit in aurigam: pariterque animaque rotisque
Expulit, et sævis compescuit ignibus ignes.
Consternantur equi, et saltu in contraria facto
Colla jugo excutiunt, abruptaque lora relinquunt.
Illic frena jacent, illic temone revulsus
Axis; in hac radii fractarum parte rotarum:
Sparsaque sunt late laceri vestigia currus.
At Phaethon, rutilos flamma populante capillos,
Volvitur in præceps, longoque per aera tractu
Fertur; ut interdum de cœlo stella sereno,
Etsi non cecidit, potuit cecidisse videri.
Quem procul a patria diverso maximus orbe
Excipit Eridanus, spumantiaque abluit ora.

The seas shrink in, and to the sight disclose
Wide naked plains, where once their billows rose;
Their rocks are all discover'd, and increase
The number of the scatter'd Cyclades;
The fish in shoals about the bottom creep;
Nor longer dares the crooked dolphin leap:
Gasping for breath the unshapen Phocæ die,
And on the boiling wave extended lie:
Nereus, and Doris with her virgin train,
Seek out the last recesses of the main;
Beneath unfathomable depths they faint,
And secret in their gloomy caverns pant;
Stern Neptune thrice above the waves upheld
His face, and thrice was by the flames repell'd.
  The Earth at length, on every side embraced
With scalding seas, that floated through her waist,
When now she felt the springs and rivers come,
And crowd within the hollow of her womb,
Uplifted to the heavens her blasted head,
And clapp'd her hand upon her brows, and said
(But first, impatient of the sultry heat,
Sunk deeper down, and sought a cooler seat):—
"If you, great kings of gods, my death approve,
And I deserve it, let me die by Jove:
If I must perish by the force of fire,
Let me transfix'd with thunder-bolts expire.
See, whilst I speak, my breath the vapours choke
(For now her face lay wrapp'd in clouds of smoke),
See my singed hair, behold my faded eye,
And wither'd face, where heaps of cinders lie!
And does the plough for this my body tear?
This the reward for all the fruits I bear,
Tortured with rakes, and harass'd all the year?
That herbs for cattle daily I renew,
And food for man, and frankincense for you?
But, grant me guilty, what has Neptune done?
Why are his waters boiling in the Sun?
The wavy empire, which by lot was given,
Why does it waste, and farther shrink from heaven?
If I nor he your pity can provoke,
See your own heavens, the heavens begin to smoke!
Should once the sparkles catch those bright abodes,
Destruction seizes on the heavens and gods;
Atlas becomes unequal to his freight,
And almost faints beneath the glowing weight.
If heaven, and earth, and sea, together burn,
All must again into their chaos turn.
Apply some speedy cure, prevent our fate,
And succour Nature ere it be too late."
She ceased; for, choked with vapours round her spread,
Down to the deepest shades she sunk her head.
  Jove call'd to witness every power above,
And even the god, whose son the chariot drove,
That what he acts he is compell'd to do,
Or universal ruin must ensue.
Straight he ascends the high ethereal throne,
From whence he used to dart his thunder down,
From whence his showers and storms he used to pour,
But now could meet with neither storm nor shower.
Then, aiming at the youth, with lifted hand,
Full at his head he hurl'd the forky brand
In dreadful thunderings. Thus the Almighty Sire
Suppress'd the raging of the fires with fire.
At once from life and from the chariot driven,
The ambitious boy fell thunder-struck from heaven;

The horses started with a sudden bound,
And flung the reins and chariot to the ground;
The studded harness from their necks they broke,
Here fell a wheel, and there a silver spoke,
Here were the beam and axle torn away,
And scatter'd o'er the earth the shining fragments lay.

The breathless Phaeton, with flaming hair,
Shot from the chariot like a falling star,
That in a summer's evening from the top
Of heaven drops down, or seems at least, to drop,
'Till on the Po his blasted corpse was hurl'd,
Far from his country, in the western world.

AURORA.

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We may also refer to the 'Story of Dædalus and Icarus,' translated by Croxall :—

In tedious exile now too long detain'd,
Dædalus languish'd for his native land;
The sea foreclosed his flight, yet thus he said;
"Though earth and water in subjection laid,
O cruel Minos, thy dominion be,
We'll go through air; for sure the air is free."
Then to new arts his cunning thought applies,
And to improve the work of nature tries.
A row of quills, in gradual order placed,
Rise by degrees in length from first to last;
As on a cliff the ascending thicket grows;
Or different reeds the rural pipe compose:
Along the middle runs a twine of flax,
The bottom stems are join'd by pliant wax;
Thus, well compact, a hollow bending brings
The fine composure into real wings.
His boy, young Icarus, that near him stood,
Unthinking of his fate, with smiles pursued
The floating feathers, which the moving air
Bore loosely from the ground, and wafted here and there:
Or with the wax impertinently play'd,
And with his childish tricks the great design delay'd—
The final masterstroke at last imposed,
And now, the neat machine completely closed;
Fitting his pinions on, a flight he tries,
And hung self-balanced in the beaten skies.
Then thus instructs his child: "My boy, take care
To wing your course along the middle air:
If low, the surges wet your flagging plumes;
If high, the sun the melting wax consumes.
Steer between both: nor to the northern skies,
Nor South Orion, turn your giddy eyes,
But follow me: Let me before you lay
Rules for the flight, and mark the pathless way."
Thus teaching, with a fond concern, his son,
He took the untried wings, and fix'd them on:
But fix'd with trembling hands; and, as he speaks,
The tears roll gently down his aged cheeks;
Then kiss'd, and in his arms embraced him fast,
But knew not this embrace must be the last;
And mounting upward, as he wings his flight,
Back on his charge he turns his aching sight;
As parent birds, when first their callow care
Leave the high nest to tempt the liquid air;
Then cheers him on, and oft, with fatal art,
Reminds the stripling to perform his part.
These, as the angler at the silent brook,
Or mountain shepherd leaning on his crook,
Or gaping ploughman, from the vale descries,
They stare, and view them with religious eyes,
And straight conclude them gods: since none but they
Through their own azure skies could find a way.
Now Delos, Paros, on the left are seen,
And Samos, favour'd by Jove's haughty queen;
Upon the right, the isle Lebynthos named,
And fair Calymne for its honey famed.
When now the boy, whose childish thoughts aspire
To loftier aims, and make him ramble higher,
Grown wild and wanton, more embolden'd flies
Far from his guide, and soars among the skies:
The softening wax, that felt a nearer sun,
Dissolved apace, and soon began to run:
The youth in vain his melting pinion shakes,
His feathers gone, no longer air he takes:
Oh! father, father! as he strove to cry,
Down to the sea he tumbled from on high,
And found his fate: yet still subsists by Fame,
Among those waters that retain his name.
The Father, now no more a father, cries:
"Ho, Icarus! where are you?" as he flies;
"Where shall I seek my boy?" he cries again,
And saw his feathers scatter'd on the main:
Then cursed his art; and funeral rites conferr'd,
Naming the country from the youth interr'd.
A Partridge from a neighbouring stump beheld
The Sire his monumental marble build;

Who, with peculiar call and fluttering wing,
Chirp'd joyful, and malicious seem'd to sing:
The only bird of all its kind, and late
Transform'd in pity to a feather'd state;
From whence, O Dædalus! thy guilt we date.
His sister's son, when now twelve years were pass'd,
Was, with his uncle, as a scholar placed;
The unsuspecting mother saw his parts,
And genius fitted for the finest arts.
This soon appear'd; for when the spiny bone
In fishes' backs was by the stripling known,
A rare invention thence he learn'd to draw,
Filed teeth in iron, and made the grating saw.
He was the first, that from a knob of brass
Made two straight arms with widening stretch to pass;
That while one stood upon the centre's place,
The other round it drew a circling space.
Dædalus envied this, and from the top
Of fair Minerva's temple let him drop;
Feigning, that as he lean'd upon the tower,
Careless, he stoop'd too much, and tumbled o'er.
The Goddess, who the ingenious still befriends,
On this occasion her assistance lends;
His arms with feathers, as he fell, she veils,
And in the air a new-made bird he sails.
The quickness of his genius, once so fleet,
Still on his wings remain, and in his feet:
Still, tho' transform'd, his ancient name he keeps,
And with low flight the new-shorn stubble sweeps,
Declines the lofty trees, and thinks it best
To brood in hedgerows o'er its humble nest;
And in remembrance of the former ill,
Avoids the heights and precipices still.
At length, fatigued with long laborious flights,
On fair Sicilia's plains the artist lights;
Where Cocalus the king, that gave him aid,
Was, for his kindness, with esteem repaid.
Athens no more her doleful tribute sent,
That hardship gallant Theseus did prevent;
Their temples hung with garlands, they adore
Each friendly god, but most Minerva's power;
To her, to Jove, to all, their altars smoke,
They each with victims and perfumes invoke.
Now talking fame, thro' every Grecian town
Had spread, immortal Theseus, thy renown:
From him, the neighbouring nations, in distress,
In suppliant terms implore a kind redress.

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The following passage I take from the 'Orlando Furioso' of Ariosto (born at Reggio, A.D. 1474), as it is strangely appropriate at this time. He describes Astolpho, an English knight, leaving the island, and winging his flight to the *Source of the Nile*. The English version is by William Stewart Rose:—

CANTO XXXIII.

XCVI.

Voglio Astolfo seguir, ch' à sella, e à morso
A uso facea andar di palafreno
L' Ippogrifo per l' aria a sì gran corso,
Che l' aquila, e il falcon vola assai meno.
Poi che de' Galli ebbe il paese scorso
Da un mare all' altro, e da Pirene al Reno,
Tornò verso Ponente alla montagna,
Che separa la Francia dalla Spagna.

Astolpho in his flight will I pursue,
That made his hippogryph like palfrey flee,
With reins and sell, so quick the welkin through;
That hawk and eagle soar a course less free.
O'er the wide land of Gaul the warrior flew,
From Pyrenees to Rhine, from sea to sea.
He westward to the mountains turned aside,
Which France's fertile land from Spain divide.

XCVII.

Passò in Navarra, ed indi in Aragona,
Lasciando à chi 'l vedea gran maraviglia.
Restò lungi à sinistra Taracona,
Biscaglia à destra, ed arrivò in Castiglia.
Vide Galizia, e 'l Regno d' Ulisbona;
Poi volse il corso à Cordova, e Siviglia:
Nè lasciò presso al mar, nè fra campagna
Città, che non vedesse in tutta Spagna.

To Arragon he past out of Navarre,
—They who beheld, sore wondering at the sight—
Then, leaves he Tarragon behind him far,
Upon his left, Biscay upon his right:
Traversed Castile, Gallicia, Lisbon, are
Seville and Cordova, with rapid flight;
Nor city on sea-shore, nor inland plain,
Is unexplored throughout the realm of Spain.

XCVIII.

Vide le Gade, e la mèta che pose
Ai primi naviganti Ercole invitto.
Per l' Africa vagar poi si dispose
Dal mar d' Atlante à i termini d' Egitto.
Vide le Baleariche famose,
E vide Eviza appresso al cammin dritto.
Poi volse il freno, e tornò verso Arzilla
Sopra 'l mar, che da Spagna dipartilla.

Beneath him Cadiz and the strait he spied,
Where whilom good Alcides closed the way;
From the Atlantic to the further side
Of Egypt, bent o'er Africa, to stray;
The famous Balearic isles descried,
And Ivica, that in his passage lay;
Towards Arzilla then he turned the rein,
Above the sea and severs it from Spain.

XCIX.

Vide Marocco, Feza, Orano, Ippona,
Algier, Buzea, tutte Città superbe;
C' hanno d' altre Città tutte corona,
Corona d' oro, e non di fronde, ò d' erbe.
Verso Biserta, e Tunigi poi sprona:
Vide Capisse, e l' Isola d' Alzerbe,
E Tripoli, e Berniche, e Tolomitta,
Sin dove il Nilo in Asia si tragitta.

Marocco, Fez, and Oran, looking down,
Hippona, Algier, he, and Bugia told,
Which from all cities bear away the crown,
No palm or parsley wreath, but crown of gold;
Noble Beserta next and Tunis Town
Capys, Alzerba's Isle, the warrior bold,
Tripoli, Berniche, Ptolomitta viewed,
And into Asia's land the Nile pursued.

C.

Tra la marina, e la silvosa schiena
Del fiero Atlante vide ogni contrada.
Poi diè le spalle à i monti di Carena;
E sopra i Cirenei prese la strada;
E traversando i campi de l' arena
Venne a' confin di Nubia in Albaiada.
Rimase dietro il Cimiter di Batto,
E 'l gran Tempio d' Amon, ch' oggi è disfatto.

'Twixt Atlas' shaggy ridges and the shore,
He viewed each region in his spacious round;
He turned his back upon Carena hoar,
And skimmed above the Cyrenæan ground;
Passing the sandy desert of the Moor,
In Albajada, reached the Nubian's bound;
Left Battus' tomb behind him on the plain
And Ammon's now dilapidated fane.

CI.

Indi giunse ad un' altra Tremisenne
Che di Maumetto pur segue lo stilo;
Poi volse agli altri Etiopi le penne,
Che contra questi son di là dal Nilo.
A la Città di Nubia il cammin tenne
Tra Dobada e Coalle in aria a filo.
Questi Cristiani son, quei Saracini,
E stan con l' arme in man sempre à' confini.

To other Tremizen he posts, where bred
As well the people are in Mahound's style;
For other Æthiops then his pinions spread,
Which face the first, and lie beyond the Nile;
Between Coallee and Dobada sped,
Bound for the Nubian city's royal pile;
Threading the two, where, ranged on either hand,
Moslems and Christians watch, with arms in hand.

CII.

Senápo Imperator de la Etiopia,
Che 'n luogo tien di scettro in man la Croce;
Di gente, di cittadi, e d' oro ha copia
Quindi fin là, dove il mar Rosso ha foce;
E serva quasi nostra fede propia,
Che può salvarlo da l' esilio atroce.
Gli è, s' io non piglio errore, in questo loco
Ove al battesmo loro usano il foco.

In Æthiopia's realm Senapus reigns,
Whose sceptre is the cross; of cities brave,
Of men, of gold possest, and broad domains,
Which the Red Sea's extremest waters lave.
A faith wellnigh like ours that king maintains,
Which man from his primeval doom may save.
Here, save I err in what their rites require,
The swarthy people are baptized by fire.

CIII.

Dismontò il Duca Astolfo à la gran Corte
Dentro di Nubia, e visitò il Senápo.

Astolpho lighted in the spacious court,
Intending on the Nubian king to wait.

He continues to describe the grandeur of the palace, and among the proofs of his power is one that forms the subject of the following stanza:—

CVI.

Si dice che 'l Soldan, Rè de l' Egitto
A quel Re dà tributo, e sta suggetto;
Perch' è in poter di lui dal cammin dritto
Levare il Nilo, e dargli altro *ricetto*;
E per questo lasciar subito afflitto
Di fame il Cairo, e tutto quel distretto.
Senápo detto è da i sudditi suoi:
Gli diciam Presto, o Preteianni noi.

The soldan, king of the Egyptian land,
Pays tribute to this sovereign, as his head,
They say, as having Nile at his command
He may divert the stream to other bed.
Hence, with its district upon either hand,
Forthwith might Cairo lack its daily bread.
Senapus him his Nubian tribes proclaim;
We Priest and Prester John the sovereign name.

The tale is carried on by incorporating the classic story of the Harpies sent by heaven to punish this rich king.

The following stanzas give the prophecy and its fulfilment of the period put to these plagues :—

CXII.

E in disperazion continua il messe
Uno, che già gli avea profetizato,
Che le sue mense non saríano oppresse
Da la rapina, e da l' odore ingrato,
Quando venir per l' aria si vedesse
Un Cavalier sopra un cavallo alato.
Perchè dunque impossibil parea questo,
Privo d' ogni speranza vivea mesto.

And him had plunged in uttermost despair
One that to him erewhile had prophesied
" The loathsome Harpies should his daily fare
" Leave unpolluted only, when astride
" Of winged horse, arriving through the air,
" An armed cavalier should be descried."
And, for impossible appears the thing,
Devoid of hope remains the mournful king.

CXIII.

Or, che con gran stupor vede la gente
Sopra ogni muro, e sopra ogn' alta torre
Entrare il Cavaliero, immantenente
E chi à narrarlo al Re di Nubia corre ;
A cui la profezia ritorna a mente ;
Ed obbliando per letizia torre
La fedel verga, con le mani innante
Vien brancolando al Cavalier volante.

Now that with wonderment his followers spy
The English cavalier so make his way,
O'er every wall, o'er every turret high,
Some swiftly to the king the news convey.
Who calls to mind that ancient prophecy,
And heedless of his staff, his wonted stay,
Thro' joy, with outstretched arms and tottering feet,
Comes forth, the flying cavalier to meet.

CXIV.

Astolfo ne la piazza del castello
Con spaziose rote in terra scese.
Poi che fu il Re condotto innanzi à quello,
Inginocchiossi, e le man giunte stese,
E disse : Angel di Dio, Messia novello,
" S' io non merto perdona à tante offese,
" Mira, che proprio è a noi peccar sovente,
" A voi perdonar sempre a chi si pente.

Within the castle court Astolpho flew,
And there, with spacious wheels, on earth descended,
The king, conducted by his courtly crew,
Before the warrior knelt with arms extended,
And cried, " Thou Angel, sent of God, thou new
" Messiah, if too sore I have offended,
" For mercy, yet, bethink thee, 'tis our bent
" To sin, and thine to pardon who repent."

* * * * * * * * * *

CXVII.

" Rispose Astolfo : Nè l' Angel di Dio,
" Nè son Messía novel, nè dal Ciel vegno ;
" Ma son mortale, e peccatore anch' io,
" Di tanta grazia, a me concessa indegno.
" Io farò ogn' opra acciò che 'l mostro rio,
" Per morte o fuga io ti levi del Regno.
" S' io il fo, me non, ma Dio ne loda solo,
" Che per tuo aiuto qui mi drizzò il volo."

" Nor angel,"—good Astolpho made reply,—
" Nor new Messiah, I from heaven descend ;
" No less a mortal or a sinner I,
" To such high grace unworthy to pretend.
" To slay the monsters I all means will try,
" Or drive them from the realm which they offend.
" If I shall prosper be thy praises paid,
" To God alone who sent me to thy aid.

CXVIII.

Fa' questi voti a Dio, debiti a lui,
A lui le Chiese edifica, e gli altari.
Così parlando, andavano ambidui
Verso il Castello fra i Baron preclari.
Il Re comanda à i servitori sui,
Che subito il convito si prepari ;
Sperando che non debba essergli tolta
La vivanda di mano a questa volta.

" Offer these vows to God, to Him well due ;
" To Him thy churches build, thine altars rear."
Discoursing so, together wend the two,
'Mid Barons bold, that King and Cavalier.
The Nubian Prince commands the menial crew
Forthwith to bring the hospitable cheer ;
And hopes that now the foul, rapacious band,
Will not dare snatch the victuals from his hand.

CXIX.

Dentro una ricca sala immantinente
Apparecchiossi il convito solenne.
Col Senápo s' assise solamente
Il Duca Astolfo, e la vivanda venne.
Ecco per l' aria lo stridor si sente
Percossa intorno da l' orribil penne.
Ecco venir l' Arpie brutte e nefande
Tratte dal cielo a odor de le vivande.

Forthwith a solemn banquet they prepare
Within the gorgeous palace of the king.
Seated alone here guest and sovereign are,
And the attendant troops the viands bring.
Behold ! a whizzing sound is heard in air,
Which echoes with the beat of savage wing.
Behold ! the band of Harpies thither flies,
Lured by the scent of victual from the skies.

CXX.

Erano sette in una schiera; e tutte
Volto di donna avean, pallide e smorte,
Per lunga fame attenuate e asciutte,
Orribili à veder, più che la morte.
L' alacce grandi avean, deformi e brutte;
Le man rapaci, e l' ugne in curve e torte;
Grande, e fetido il ventre, e lunga coda,
Come di serpe, che s' aggira, e snoda.

All bear a female face of pallid dye,
And seven in number are the horrid band;
Emaciated with hunger, lean, and dry;
Fouler than death; the pinions they expand,
Ragged and huge and shapeless to the eye;
The talon crooked; rapacious is the hand;
Fetid and large the paunch; in many a fold,
Like snakes their long and knotted tails are rolled.

CXXI.

Si sentono venir per l' aria, e quasi
Si veggon tutte à un tempo in sù la mensa
Rapire i cibi, e riversare i vasi;
E molta feccia il ventre lor dispensa,
Tal ch' egli è forza d' atturare i nasi,
Chè non si può patir la puzza immensa.
Astolfo, come l' ira lo sospinge,
Contra gli ingordi augelli il ferro stringe.

The fowls are heard in air; then swoops amain;
The covey wellnigh in that instant, rends
The food, o'erturns the vessels, and a rain
Of noisome ordure on the board descends.
To stop their nostrils king and duke are fain;
Such an insufferable stench offends.
Against the greedy birds, as wrath excites,
Astolpho with his brandished faulchion smites.

The three next stanzas give the account of the success of the Harpies, the despair of the king, and the resolve of Astolpho to use his magic horn. So he again tempts the monsters, as follows:—

CXXV.

E così in una loggia s'apparecchia
Con altra mensa altra vivanda nuova.
Ecco l' Arpie, che fan l' usanza vecchia:
Astolfo il corno subito ritrova.
Gli augelli, che non han chiusa l' orecchia,
Udito il suon, non pon stare à la prova;
Ma vanno in fuga pieni di paura,
Nè di cibo, nè d' altro hanno più cura.

CXXVI.

Subito il Paladin dietro lor sprona;
Volando esce il destrier fuor de la loggia,
E col castel la gran Città abbandona;
E per l' aria, cacciando i mostri, poggia.
Astolfo il corno tuttavolta suona:
Fuggon l' Arpie verso la Zona roggia
Tanto che sono à l' Altissimo monte,
*Ove il Nilo ha, se in alcun luogo ha, fonte.*

CXXVII.

Quasi de la montagna à la radice
Entra sotterra una profonda grotta
Che certissima porta esser si dice
Di chi à l' Inferno vuol scender talotta.
Quivi s' è quella turba predatrice,
Come in sicuro albergo, ricondotta,
E giù sin di Cocito in sù la proda
Scesa, e più là, dove quel suon non oda.

CXXVIII.

A l' infernal caliginosa buca,
Ch' apre la strada à chi abbandona il lume,
Finì l' orribil suon l' inclito Duca,
E fe raccorre al suo destrier le piume.*

The tale continues to describe the descent of the English Paladin after tying up his winged steed, the horrors, and his forced retreat on account of the poisonous fumes. He stops up the mouth of the cavern, and —

## CANTO XXXIV.

XLVIII.

Poi monta il volatore, e in aria s' alza
Per giunger di quel monte in sù la cima,
Che non lontan con la superna balza
Dal cerchio de la Luna esser si stima.
Tanto è il desir, che di veder l' incalza,
Ch' al cielo aspira, e la terra non stima.
De l' aria più, e più sempre guadagna;
Tanto, ch' al giogo va de la montagna.

Then backed the griffin-horse, and soared a flight
Whereby to reach the mountain tops he schemes;
Which little distant, with its haughty height,
From the moon's circle good Astolpho deems;
And such desire to see it warms the knight,
That he aspires to heaven, nor ease esteems.
Through air so more and more the warrior strains,
That he at last the mountain-summit gains.

* I omit the English in these and some of the following stanzas, where I think the translation falls far short of the original.

*Bellerophon fights the Chimæra*

A glowing description of beautiful scenery follows, and of the gorgeous palace, where—

LIV.

Nel lucente vestibulo di quella
Felice casa un Vecchio al Duca occorre,
Che 'l manto ha rosso, e bianca la gonnella,
Che l' un può al latte, e l' altro al minio opporre.
I crini ha bianchi, e bianca la mascella
Di folta barba, che al petto discorre;
Ed è sì venerabile nel viso,
Che un degli eletti par del Paradiso.

LV.

Costui con lieta faccia ál Paladino,
Chè riverente era d' arcion disceso,
Disse: O Baron, che per voler divino
Sei nel terrestre Paradiso asceso,
Come che nè la causa del cammino,
Nè il fin del tuo desir da te sia inteso;
Pur credi che non senza alto misterio
Venuto sei dall' artico emisperio.

* * * * *

LVII.

* * * * *

Continuando il Vecchio i detti suoi
Fece maravigliare il Duca assai
Quando, scoprendo il nome suo, gli disse
Esser colui, che l' Evangelio scrisse;

LVIII.

Quel tanto al Redentor caro Giovanni
Per cui 'l sermone tra i fratelli uscío,
Che non dovea per morte finir gli anni:
Sì che fu causa, che 'l Figliuol di Dio
A Pietro disse: Perchè pur t' affanni,
S' io vo' che così aspetti il venir mio?
Benché non disse: Egli non de' morire;
Si vede pur, che così volle dire.

LIX.

Quivi fu assunto, e trovò compagnía,
Chè prima Enoch, il Patriarca, v' era:
Eravi insieme il gran Profeta Elía,
Che non han vista ancor l' ultima fera,
E fuor dell' aria pestilente e ria
Si goderan l' eterna Primavera,
Fin che dian segno le Angeliche tube,
Che torni Cristo in su la bianca nube.

LX.

Con accoglienza grata il Cavaliero
Fu dai Santi alloggiato in una stanza;
Fu provvisto in un' altra al suo destriero
Di buona biada che gli fu a bastanza.
De' frutti a lui del Paradiso diero,
Di tal sapor, che a suo giudicio, sanza
Scusa non sono i duo primi Parenti,
Se per quei fur sì poco ubbidienti.

The following stanzas are the conversations that ensue, in the course of which St. John informs the English cavalier that he has a mission to perform in recovering Orlando's wits, and thus concludes:—

## CANTO XXXIV.

LXVII.

" Gli è ver che ti bisogna altro viaggio
" Far meco, e tutta abbandonar la Terra.
" Nel cerchio della Luna a menar t' aggio,
" Che dei pianeti a noi più prossima erra;
" Perchè la medicina, che può saggio
" Rendere Orlando, la dentro si serra.
" Come la Luna questa notte sia
" Sopra noi giunta, ci porremo in via."

" 'Tis true to journey further ye will need,
" And wholly must you leave this nether sphere;
" To the moon's circle you I have to lead,
" Of all the planets to our world most near.
" Because the medicine, that is fit to speed
" Insane Orlando's cure, is treasured here.
" This night will we away, when overhead
" Her downward rays the silver moon shall shed."

LXVIII.

Di questo, e d' altre cose fu diffuso
Il parlar dell' Apostolo quel giorno.
Ma poi che 'l Sol s' ebbe nel mar rinchiuso,
E sopra lor levò la Luna il corno;
Un carro apparecchiossi, ch' era ad uso
D' andar scorrendo per quei Cieli intorno:
Quel già nelle montagne di Giudea
Da' mortali occhi Elía levato avea.

In talk the blessed apostle is diffuse
On this and that, until the day is worn;
But when the sun is sunk i' the salt-sea ooze,
And overhead the moon uplifts her horn,
A chariot is prepared, erewhile in use
To scour the heavens, wherein of old was borne
From Jewry's misty mountains to the sky
Sainted Elias, rapt from mortal eye.

ASTOLPHO AND ST. JOHN.

LXIX.

Quattro destrier via più che fiammi rossi,
Al giogo il santo Evangelista aggiunse;
E poi che con Astolfo rassettossi,
E prese il freno, in verso il Ciel li punse.
Ruotando il carro per l' aria levossi,
E tosto in mezzo il fuoco eterno giunse;
Che 'l Vecchio fè miracoloramente,
Che, mentre lo passár, non era ardente.

Four goodly coursers next, and redder far
Than flame, to that fair chariot yokes the sire;
Who, when the knight and he well seated are,
Collects the reins; and heavenward they aspire.
In airy circles swiftly rose the car,
And reached the region of eternal fire;
Whose heat the saint by miracle suspends,
While through the parted air the pair ascends.

LXX.

Tutta la Sfera varcano del foco,
Ed indi vanno al Regno della Luna.
Veggon per la più parte esser quel loco,
Come un acciar, che non ha macchia alcuna;
E lo trovano uguale, o minor poco
Di ciò, ch' in questo globo si raguna,
In questo ultimo globo della Terra,
Mettendo il mar che la circonda e ferra.

The chariot, towering, threads the fiery sphere,
And rises thence into the lunar reign.
This, in its larger part they find as clear
As polished steel, when undefiled by stain;
And such it seems, or little else, when near,
As what the limits of our earth contain:
Such as our earth, the last of globes below,
Including seas, which round about it flow.

LXXI.

Quivi ebbe Astolfo doppia maraviglia;
Che quel paese appresso era sì grande,
Il quale a un picciol tondo rassimiglia
A noi che lo miriam da queste bande;
E che aguzzar conviengli ambe le ciglia,
S' indi la Terra, e 'l mar, ch' intorno spande,
Discerner vuol; chè non avendo luce,
L'immagin lor poco alta si conduce.

Here doubly waxed the paladin's surprise,
To see that place so large, when viewed at hand;
Resembling but a little hoop in size,
When from the globe surveyed whereon we stand,
And that he both his eyes behoved to strain,
If he would view Earth's circling seas and land;
In that, by reason of the lack of light,
Their images attained to little height.

LXXII.

Altri fiumi, altri laghi, altre campagne
Sono là su, che non son quì tra noi:
Altri piani, altre valli, altre montagne,
Che han le Cittadi, hanno i Castelli suoi,
Con case, delle quai mai le più magne
Non vide il Paladin prima, nè poi;
E vi sono ample, e solitarie selve,
Ove le Ninfe ognor cacciano belve.

LXXIII.

Non stette il Duca a ricercare il tutto;
Chè là non era asceso a quello effetto.
Dall' Apostolo santo fu condutto
In un vallon fra due montagne stretto;
Ove mirabilmente era ridutto
Ciò, che si perde o per nostro difetto,
O per colpa di tempo, o di fortuna.
Ciò, che si perde quì, là si raguna.

The stanzas following these describe many wondrous scenes, and, in the 87th, his own object is realised :—

La più capace, e piena ampolla ov' era
Il senno che solea far savio il Conte,
Astolfo tolle; e non è sì leggiera,
Come stimò, con l' altre essendo a monte.
Prima che 'l Paladin da quella Sfera
Piena di luce alle più basse smonte,
Menato fu dall' Apostolo santo
In un Palagio, ov' era un fiume a canto.

## CANTO XXXVIII.

XXIV.

Sceso era Astolfo dal giro lucente
Alla maggiore altezza della Terra,
Con la felice ampolla che la mente
Dovea sanare al gran Mastro di guerra.
Un' erba quivi di virtù eccellente
Mostra Giovanni al Duca d' Inghilterra.
Con essa vuol ch' al suo ritorno tocchi
Il Rè di Nubia, e gli risani gli occhi;

XXV.

Acciò per questi, e per li primi merti
Gente gli dia, con che Biserta assaglia;
E, come poi quei popoli inesperti
Armi, ed acconci ad uso di battaglia,
E senza danno passi pei deserti
Ove l' arena gli uomini abbarbaglia;
A punto a punto l' ordine che tegna,
Tutto il Vecchio santissimo gl' insegna.

XXVI.

Poi lo fè rimontar su quello Alato,
Che di Ruggiero, e fu prima d' Atlante.
Il Paladin lasciò, licenziato
Da San Giovanni, le contrade sante;
E, secondando il Nilo a lato a lato,
Tosto i Nubi apparir si vide innante;
E, nella Terra, che del Regno è capo,
Scese dall' aria, e ritrovò il Senàpo.

XXVII.

Molto fu il gaudio, e molta fu la gioja,
Che portò o quel Signor nel suo ritorno;
Chè ben si ricordava della noja,
Che gli avea tolta dell' Arpie d' intorno.
Ma poi che la grossezza gli discuoja
Di quell' umor, che già gli tolse il giorno,
E che gli rende la vista di prima,
L' adora e cole, e come un Dio sublima.

Astolpho again used his steed on several occasions, and wrought many wonders, but my quotations are already long enough.

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TASSO.—Born at Sorrento, A.D. 1544. Translation, by Edward Fairfax, A.D. 1600, and by J. Wiffen.

## CANTO I.

The Angel Gabriel.

XIV.

Ali bianchi vestì, ch' han d' or le cime,
Infaticabilmente agili e preste.
Fende i venti e le nubi, e va sublime
Sovra la terra e sovra il mar con queste:
Così vestito, indirizzossi all' ime
Parti del mondo il Messaggier celeste:
Pria sul Libano monte ei si ritenne,
E si librò sull' adeguate penne.

Of silver wings he took a shining pair,
Fringed with gold, unwearied, nimble, swift;
With these he parts the winds, the clouds, the air,
And over seas and earth himself doth lift.
Thus clad, he cuts the spheres and circles fair,
And the pure skies with sacred feathers clift:
On Lebanon at first his foot he set
And shook his wings with rory May-dews wet.

The wizard Ismene conveys the Soldan from the battlefield to Jerusalem by the means described in the following stanzas :—

## CANTO X.

XV.

E sovra un carro suo, che non lontano
Quinci attendea, col fier Nicendo ei siede:
Le briglie allenta, e con maestra mano
Ambo i corsieri alternamente fiede.
Quei vanno sì che 'l polveroso piano
Non ritien della rota orma o del piede:
Fumar gli vedi ed anelar nel corso,
E tutto biancheggiar di spuma il morso.

His magic car stood ready at command,
They mount; the Stranger, shunning all delay,
Shook the rich reins, and with a master's hand
Lashed the black steeds, that, ramping, scoured away
So swift, that not the sands a trace betray
Of hoof or wheel; they vanish as they come,
Proudly precipitant, and snort, and neigh,
Paw the parched soil, and, ardent for their home,
Champ their resplendent bits all white with fleecy foam.

XVI.

Meraviglie dirò: s' aduna e stringe
L' aer d' intorno in nuvolo raccolto,
Sì che 'l gran carro ne ricopre e cinge,
Ma non appar la nube o poco o nolto;
Nè sasso che mural macchina spinge,
Penetreria per lo chiuso e folto:
Ben veder ponno i duo dal cavo seno
La nebbia intorno, e fuori il ciel sereno.

Away! away! and still as fast and far
They fly, the air to clouds condensing rolled
In heaps around, and draped th' enchanted car,
Yet not a wreath could human eye behold;
Nor stone nor rock (surprising to be told,)
Hurled from the most magnificent machine,
Might of its crapelike volume pierce the fold!
Yet by the two within were all things seen—
The clouds, air, earth, and sky, all rosily serene.

XVII.

Stupido il cavalier le ciglia inarca,
Ed increspa la fronte, e mira fiso
La nube e 'l carro ch' ogni intoppo varca
Veloce sì, che di valar gli è avviso.
L' altro che di stupor l' anima carca
Gli scorge all' atto dell' immobil viso,
Gli rompe quel silenzio, e lui rappella;
Ond' ei si scote, e poi così favella:

With wrinkling forehead and arched brow, the knight
On cloud and car gazed stupidly intent,—
Its wheels seemed wings, and its career a flight,
So swift and soundless on its way it went
O'er the smooth soil; the Sage plenipotent,
Who saw his raptured spirit stand aghast
At the sublime and mystical portent,
From his abstraction roused him; voice at last
Came to his lips, from which these eager questions passed.

* * * * * * * * * *

XXV.

Così gir ragionando, insin che furo
Là 've presso vedean le tende alzarse:
Che spettacolo fu crudele e duro!
E in quante forme ivi la morte apparse!
Si fe' negli occhi allor torbido e scuro,
E di doglia il soldano il volto sparse.
Ahi con quanto dispregio ivi le degne
Mirò giacer sue già temute insegne!

Thus commune they; and now the plain they pass,
Near which their domes the white pavilions rear;
There what a cruel sight was seen! alas,
In what unnumbered shapes did death appear!
To Solyman's stern eyes a troubled tear
Of grief and passion rose at the survey,
And filled his face with gloom; afar and near,
In what wild havoc, how insulted, lay
His arms and ensigns, feared, so feared of yesterday!

XXVI.

E scorrer lieti i Franchi, e i petti e i volti
Spesso calcar de' suoi più noti amici;
E con fasto superbo agl' insepolti
L' arme spogliare e gli abiti infelici;
Molti onorare in lunga pompa accolti
Gli amati corpi degli estremi uffici:
Altri soppor le fiamme, e 'l volgo misto
D' Arabi e Turchi, a un foco arder è visto.

He saw the Franks in carnival o'erspread
The field, oft trampling on the faces pale
Of his slain friends, as from th' unburied dead
They tore the gorgeous vests and shirts of mail,
With rude insulting taunts: down the far vale,
In long, long order, many a funeral quire
Was seen attending with the voice of wail
Bodies beloved, whilst some brought careless fire,
And Turks and Arabs heaped in one commingling pyre.

XXVII.

Sospirò dal profondo, e 'l ferro trasse
E dal carro lanciossi, e correr volle;
Ma il vecchio incantatore a se il ritrasse
Sgridando, e raffrenò l' impeto folle;
E fatto che di nuovo ei rimontasse,
Drizzò il suo corso al più sublime colle.
Così alquanto n' andaro, insin ch' a tergo
Lasciar de' Franchi il militare albergo.

He deeply sighed, he drew his sword in rage,
And from his seat leaped, eager in their blood
T' avenge the insult; but the Archimage
His mad resolve inflexibly withstood;
And, curbing by rebuke his furious mood,
Made him perforce resume the seat resigned;
Then to the loftiest hills his course pursued,
Baffling the rival pinions of the wind,
Until the hostile tents in distance sank behind.

XXVIII.

Smontaro allor dal carro, e quel repente
Sparve, e presono a piedi insieme il calle,
Nella solita nube occultamente,
Discendendo a sinistra in una valle,
Sin che giunsero là dove al ponente
L' alto monte Sion volge le spalle.

Alighting then, the chariot disappeared,
And side by side on foot the travellers went;
Still curtained in the cloud, their course they steered
Down a deep vale of difficult descent,
Till they arrived where to the Occident
Sublime Mount Sion turned its shoulders wide,
In rocks and cliffs fantastically rent.

## CANTO XIV.

III.

Da questa or quel ch' al pio Buglion discende,
L' ali dorate inverso lui distende.

This dream to pious Godfrey now descends,
And o'er his placid face its radiant wings extends.

IV.

Nulla mai visìon nel sonno offerse
Altrui sì vaghe immagini o sì belle,
Come ora questa a lui, la qual gli aperse
I secreti del cielo e delle stelle:
Onde, siccome entro uno speglio, ei scerse
Ciò che lassuso è veramente in elle:
Pareagli esser traslato in un sereno
Candido, è d' auree fiamme adorno e pieno.

Such semblances, such shapes, such portraits fair,
Did never yet in dream or sleep appear,
For all the forms in sea, in earth, or air,
The signs in heav'n, the stars in every sphere,
All what was wondrous, uncouth, strange and rare,
All in that vision well presented were,
His dream had placed him in a crystal wide,
Beset with golden fires, top, bottom, side.

V.

E mentre ammira in quell' eccelso loco
L' ampiezza, i moti, i lumi e l' armonia,
Ecco cinto di rai, cinto di foco,
Un cavaliero incontra a lui venia,
E 'n suono allato a cui sarebbe roco
Qual più dolce è quaggiù, parlar l' udia:
Goffredo, òr non m' accogli, e non ragione
Al fido amico? or non conosci Ugone?

Here, as the moving spheres, the vast blue sky,
The lights, and the rich music he admires,
Lo, to his side a winged knight draws nigh,
With sunbeams crowned, and circumfused with fires!
And in a voice to which the clearest choirs
And perfect marriage of sweet sounds below,
Would be but discord, said, "Canst thou bestow
No smile, or dost thou not thy once-loved Hugo know

VI.

Ed ei gli rispondea: quel novo aspetto
Che par d' un sol mirabilmente adorno,
Dall' antica notizia il mio intelletto
Svìato ha sì, che tardi a lui ritorno.
Gli stendea poi con dolce amico affetto
Tre fiate le braccia al collo intorno
E tre fiate invan cinta l' immago
Fuggia, qual leve sogno od aer vago.

To which the Duke replied; "That aspect new,
Which like the glowing sun so brightly shines,
Has dazzled so mine intellectual view,
That it can ill recall its ancient lines:"
And saying this, to greet him he inclines;
Thrice with a fond affectionate embrace
Around his neck his loving arms he twines;
And thrice th' encircled form and radiant face
Fly like the summer cloud, or shade the sunbeams chase.

VII.

Sorridea quegli e, non già, come credi,
Dicea, son cinto di terrena veste:
Semplice forma, e nudo spirto vedi
Qui, cittadin della città celeste.

Prince Hugo smiled; "And think not, as of old,"
He said, "that earthly robes my limbs invest;
My naked spirit here dost thou behold,
A simple shape; I dwell, a glorious guest,
In this th' illumined City of the Blest:

* * * * * * * * * *

IX.

Ma, perchè più lo tuo desir s' avvive
Nell' amor di quassù, più fiso or mira
Questi lucidi alberghi e queste vive
Fiamme, che mente eterna informa e gira;
E in angeliche tempre odi le dive
Sirene, e 'l suon di lor celeste lira.
China poi disse, e gli additò la terra
Gli occhi a ciò che quel globo ultimo serra.

"But now look round more fixedly; behold—
To quicken for the skies thy pure desires,
Those lucid walls and starry orbs of gold,
Which, whirling round, th' Eternal Mind inspires!
Observe the beauty of those siren choirs
Of seraphs; hear the angelical sweet strains,
In concord sung to their celestial lyres;
Next view," he said, and pointed to the plains
Of earth, "below, what yon terrestrial globe contains."

X.

Quanto è vil la cagion ch' alla virtude
Umana è colaggiù premio e contrasto!
In che picciolo cerchio, e fra che nude
Solitudini è stretto il vostro fasto!
Lei, come isola, il mare intorno chiude;
E lui ch' or ocean chiamate, or vasto,
Nulla eguale a tai nomi ha in se di magno;
Ma è bassa palude e breve stagno.

"Think of your earthly titles and designs;
With what a vile reward is virtue crowned!
Mark what a little ring your pride confines!
What naked deserts your vain glories bound!
Earth like an island the blue sea flows round.
Now called the Mighty Deep from coast to coast,
Now, the vast Ocean; to that pompous sound
Nought corresponds, to authorise such a boast—
'Tis but a shallow pool, a narrow marsh at most."

XI.

Così l' un disse; a l' altro ingiuso ilumi
Volse, quasi sdegnando, e ne sorrise;
Che vide un punto sol mar, terre, e fiumi,
Che qui paíon distinti in tante guise;
Ed ammirò che pur all' ombre, ai fumi.
La nostra folle umanità s' affise,
Servo imperio cercando e muta fama,
Nè miri il ciel ch' a se n' invita e chiama.

The Spirit said: and he his sight let fall
On earth, and smiled with a serene disdain;
Shrunk to a point, seas, streams, and mountains tall
He sees, remote, but here distinguished plain;
And much he wondered that weak man should strain
At shades and mists that swim before his eyes,
And chase those radiant bubbles of the brain—
Capricious Fame, and Power, that, followed, flies,
Nor heeds th' inviting voice that calls him to the skies.

Tasso thus describes the flight of Armida from Western Europe to Assyria, through stormy skies, in her aërial wain:—

CANTO XVI.

LXIX.

Ella sul carro suo, che presto aveva,
S' asside e, come ha in uso, al ciel si leva.

Her chariot nigh
She as is usual mounts, and fast away doth fly.

LXX.

Calca le nubi, e tratta l' aure a volo,
Cinta di nembi e turbini sonori:
Passa i lidi soggetti all' altro polo,
E le terre d' ignoti abitatori;
Passa d' Alcide i termini, nè 'l suolo
Appressa degli Esperii, o quel de' Mori;
Ma su i mari sospeso il corso tiene,
Infin che ai lidi di Soria perviene.

The clouds she cleaves, and round her doth enroll
Thunders and tempests, lightnings, wave, and wind;
The regions subject to the southern pole,
And all their unknown natives left behind,
Calpe she crossed; nor, in her fretful mind,
Stooped to the Spaniard, or the Moor, but o'er
The Midland Sea her winged car inclined;
Nor to the right, nor to the left hand bore,
Till in mid air she reached the known Assyrian shore.

LXXI.

Quinci a Damasco non s' invia, ma schiva
Il già sì caro della patria aspetto,
E drizza il carro all' infeconda riva,
Ov' è tra l' onde il suo castello eretto.
Qui giunta, i servi e le donzelle priva
Di sua presenza, e sceglie ermo ricetto,
E fra vari pensier dubbia s' aggira:
Ma tosto cede la vergogna all' ira.

Not now to fair Damascus does she post,
But shuns the aspect of her once dear land,
And guides her chariot to the Dead Sea coast,
Where the strongholds of the Enchantress stand.
Alighting here, she from her duteous band
Of damsels and of pages hides her face,
And, wandering lonely on the sea-beat strand,
Where in sad thoughts a thousand doubts she cast,
Till grief and shame, to wrath gave place at last.

I complete this chapter with several curious extracts from old writers, bearing more or less on the subject of Aerostation. They are cited by M. Rozier in his 'Dissertation sur les Aerostates des Anciens' (Geneva, 1784). The first relates to the automaton Dove made by Archytas of Tarentum (400 to 345 B.C.), which is thus noticed by Aulus Gellius, in his 'Attic Nights.'

Many accounts of this sort appear to have been given in the name of Democritus by ignorant men, who sheltered themselves under the rank and authority of others. But that which Archytas the Pythagorean is related to have invented and perfected is not less marvellous, though it appears less absurd; for many men of eminence among the Greeks, and Favorinus the philosopher, a most vigilant searcher into antiquity, have, in a most positive manner, assured us that the model of a Dove or Pigeon formed in wood by Archytas, was so contrived, as by a certain mechanical art and power to fly: so nicely was it balanced by weights, and put in motion by hidden and enclosed air.

Horace ('Odes' I. 28) refers to his performances, especially his experiments with the Sphere:—

Te, maris et terræ numeroque carentis arenæ,
Memorem cohibent, Archyta.
Pulveris exigui, prope litus parva Matinum
Minerva. Nec quidquam tibi prodest
Aerias tentasse domos, animoque rotundum
Percurrisse polum, morituro.
HORACE, *Carm.* I. 28.

Archytas! thou sage, who measured the Earth and the Sea; and did count the grains of sand that are infinite in number, now that you lie extended near the Matinian shore, covered only with a small quantity of dust, is it of any service to you, who wert so soon to die, that you penetrated into the broad heavens, and by a vast and comprehensive understanding, extended your views from one Pole to the other?

Claudian, in his 'Epigrams,' makes Jove speak as follows, of the Sphere of Archimedes:—

Jupiter in parvo cum cerneret æthera vitro
Risit, et ad superos talia dicta dedit.
Huccine mortalis progressa potentia curæ?
Jam meus in fragili luditur orbe labor.
Jura poli, rerumque fidem, legesque Deorum,
Ecce Syracusius transtulit arte senex.
Inclusus variis famulatur spiritus astris
Et vivum certis motibus urget opus.
Percurrit proprium mentitus signifer annum
Et simulata novo Cynthia mense redit,
Jamque suum volvens, audax industria mundum
Gaudet, et humanâ sidera mente regit.
Quid falso insontem tonitru Salmonea miror?
Æmula naturæ parva reperta manus.

When in a narrow glass Jove saw the skies,
He smiled, and thus to gods expressed surprise:
"See, how man's talents imitate our ways;
"My heavenly work a fragile globe displays:
"An aged Syracusan, by his skill,
"Arranges poles, laws, harmony, at will,
"To stars, a secret spring gives motion true:
"The parts with steadiness their path pursue;
"A zodiac, framed by hand, receives the Sun.
"Which through the year, proceeds his course to run;
"And Cynthia, feigned, is seen each month to trace
"The orbit o'er, and again show her face.
"Audacious art, the world with pleasure, rolls:
"The human mind celestial orbs controls.
"Why, at Salmoneus' thunder, wonder feel?
"All Nature's plan, those fingers can reveal."

Many authors have endeavoured to throw a light on the mechanism of this wonderful Sphere; and perhaps the best explanation is that due to Cardan, as given by Gasper Schott or Schottus, in his 'Magia Universalis':—

Cardan considered it probable, in his statement of the matter of the Sphere, that it was not put in motion by the application of weights, but by rarefied enclosed air. "For," he says, "weights could with difficulty be enclosed, and when enclosed could not maintain perpetual motion, and would disfigure the works; while external wheels in motion on one side only would communicate an objectionable power to the glass. Therefore it was a much easier task for Archimedes to set them in motion by rarefied air, especially as in this case he had to give only one motion to the wheels, when placed around the same centre, as Callippus and Eudoxus had done; but the Earth itself, a small sphere, he kept going by complex motion *in medio*, by some unexplained means."

Cardan has the following remarks on the Pigeon, in his 'Variarum Rerum,' book xii. chap. 58 :—

It has been questioned whether a wooden pigeon could be made such as we have stated elsewhere, on the authority of Gellius, to have been fabricated by Archytas of Tarentum, which would be able, without external movement, to take flight, and when it rested remain immovable. Now we have seen images and statues moving on tables impelled by concealed wheels, and also a bird so constructed flying; but not with motive power of its own. Consequently we can with difficulty conceive that any sort of an Automaton can be made with power to raise itself, for the chains which contribute its motive power must be solidly and substantially constructed, and therefore too heavy to be impelled by their own force. But we see no reason why such construction should not be put in motion particularly by a favourable breeze, when the size of the wings is considered and the impulsion of the wheels which move them. The light construction of the body would contribute to this result, as would likewise the largeness of the wings and the strength of the wheels, aided by the wind, and of which geese and the heavier birds intuitively avail themselves; and it is probable that this pigeon would take its flight in a certain fashion, but with a wavering power, as lamps do. Thus it would occasionally mount upwards spontaneously, flutter its wings, then leave off suddenly, and fall, the motive power being unequal to the weight.

Lauretus Laurus enlarged on the subject. He is also quoted by Schottus in his 'Magia Universalis':—

The shells of hen-eggs, if properly filled and well secured against the penetration of the air, and exposed to solar rays, will ascend to the skies, and sometimes suffer a natural change. And if the eggs of the larger description of swans, or leather balls, stitched with fine thongs, be filled with nitre, the purest sulphur, quicksilver, or kindred materials, which rarefy by their caloric energy, and if they externally resemble pigeons, they will easily be mistaken for flying animals. If we should desire to give aerial motion to a wooden and ponderous machine we must apply fire. Should there be any apprehension of the pigeon being burned, it can be covered over with some incombustible coating, and tubes of tin introduced, so that the fire may be kept alight in its bosom without injury to it. To prevent the crackling of the flames and the emission of the sparks, the gunpowder may be deprived of force by the mixture of ochre and butter. An artificial throat may be formed to change the crackling of the flames into an imitation of the cooing of a pigeon, somewhat after the manner (too unfortunately for himself) practised by Perillus in the formation of his bull. And thus a contrivance could be adopted which escaped the ingenuity of Archytas, and the want of which was the cause why his pigeon was unable to rise again when once it descended to the ground. Tubes could have been easily constructed to ascend one after the other at convenient intervals, so that the pigeon would apparently be endued with life.

The Jesuit Schottus, already mentioned, has collected the ideas of many authors who had written on Nature's miracles. He throws great light on the production and use of gas, in his 'Magia Universalis.'

Mendoza (in 'Viridario,' lib. iii. probl. 47) discusses a problem which previous writers had touched on. For having demonstrated the fact that fire is more subtile, rare, and of less gravity than air, it follows as a corollary from these premisses that it collects the air when contiguous to the fire.

In support of this opinion Mendoza asserts that, should a vessel be raised above the convex superficies of the air, it may be sustained in that air and propelled with oars, if there be not another counteracting force.

We find by experience that substances of greater gravity than water will, when filled with air, float in that element, and which if not so filled would immediately sink. This may be seen in the case of a skin, or in that of any brass or iron vessel which when filled with air is sustained on the surface of the water and not submerged, although its specific gravity is much greater than that of water.

Relying on this experience Mendoza thus completes the argument. "Any brass vessel full of air, which otherwise would sink, is sustained on the surface of the water though naturally of much greater specific gravity, consequently a wooden ship, or one of any other material, placed on the summit of an aerial superficies and filled with elementary fire, will be sustained in that position till the gravity of the vessel becomes greater than the sustaining power of the fire it contains. Nor is the nature of fire sufficiently unruly to ignite and consume the timber, for the fire has not sufficient inherent energy to burn; as those philosophers have ingeniously proved, who agree in placing fire in the hollow of the moon."

In such terms has this matter been treated by Mendoza (died 1626), nor is there any improbability involved in his view, whether the element of fire be placed above the air, or what is still more credible, the ether—that is the purest air. Although any wood, iron, copper, lead, and such like metals are weightier than an equal volume of water, and for that reason will sink in water when there placed alone, yet if fabricated into hollow shapes, and filled with our impure and heavy air they swim upon waters and are adapted to the construction of ships, and are sustained by water without danger of immersion; thus although these bodies are of greater specific gravity than our air, nevertheless, when shaped into a boat and filled with that very light material, they can float in the air, and are suitable materials for the construction of small ships, because the entire work composed of the little ship and the ether can be made lighter than an equal volume of our impure air, even in the highest region.

Albertus Magnus (born about A.D. 1190), at the end of his work 'De Mirabilibus Naturæ,' says:—

Take one pound of sulphur, two pounds of willow-carbon, six pounds of rock-salt ground very fine in a marble mortar. Place, when you please, in a covering made of flying papyrus to produce thunder. The covering in order to ascend and float away should be long, graceful, well filled with this fine powder; but to produce thunder, the covering should be short, thick, and half full.

This receipt is to be found in the 'Secrets of Decker,' liv. iii., under the title of Flying Fire. Magic was the guise of the dark ages for the progress made by a few in chemistry. The following is an instance, from Remigius, in his 'Dæmonolatria,' cap. 25:—

There is no doubt the following will be considered incredible by all, and perhaps ridiculous by many; yet I can aver that two hundred persons testified to its truth, who, when I held the office of Duumvir, were condemned by me for arson, and thus atoned their crime of sorcery. On stated and regular days they assembled in a crowd on the bank of some lake or river, secluded from the observation of passers-by, and there they were in the habit of lashing the water with a wand received from a demon, till such time as vapours and mists were produced in large quantities, and with these they were wont to soar on high. The exhalations thus provoked condensed themselves into thick and darkling clouds, agitated and swept the heavens, assisted in their atmospheric war by the evil spirits whom they wrapped in their folds, and at length in a hailstorm smote the earth in their fury.

Salome and Dominica Zabella add, that before they thus agitated the water they were in the practice of throwing into it an earthen pot, in which, a little previous, a demon had been enclosed, without the knowledge of the lookers on, or some stones of such size as they wished the hail to be.

Decker Maygeth states that he and his confederates in crime used to receive candles from a demon of an azure colour, and sail with them some distance from the margin of Lake Fonterssgrube, hold the light downwards, and let them drop freely into the water; that after that they scattered and spread some medicinal powder over the surface, that they then with black rods bestowed on them by his demon most vehemently lashed the waters, accompanying the action with a repetition of incantations calculated to produce the desired results. When all this had been done, the sky became overcast with clouds, and discharged torrents of rain and hail on those localities which they pointed out. The mode practised to excite the clouds was not confined to the middle ages. Pausanias tells us it prevailed for many ages in Arcadia, and was practised on Mount Lycam in that country. In that country, he says, was a fountain named Agno, naturally so admirable that the art of divination was there cultivated in a very curious manner, the water being gently moved with a branch of an oak, in a short time there arose from it a vapour like a small cloud, which, soon expanding and embracing others, discharged heavy showers. This incantation, therefore, is not an invention of modern ages. It is not the invention of old hags, whose mental powers were depraved by demons, or perverted by visions or dreams, it was practised by men of keen intellects, and acute investigation, who minutely observed, critically examined, and deliberately adopted their convictions.

Barbelina Rayal adds, that tubs turned upside down were propelled through the air by sorcerers, assisted by demons, and hovered for some short time over the spots which had been doomed to calamity, and at length shattered into stones and flames, inflicted sudden injury, and crushed every impediment.

Also Delrio, in his 'Disquisit. Magic.,' lib. ii. quæst. 11 and 12:—

Marcus the Venetian (Marco Polo) in his travels in Asia relates, that the Tartars are able, through the arts of demons, to excite storms and fogs when and where they please, and that on one occasion, when entrapped by robbers, by such means, he effected his escape with difficulty. Hiatonus also (*Hist. Sarmatiæ*) relates that the army

of the Tartars being in a battle and forced to break the line, was rallied by their standard-bearer, who happened to be a magician, and who involved the enemy in profound darkness by his incantations.

Magicians can, by the agency of certain minerals, produce meteorological results, which, though seeming to be miraculous, are, nevertheless, natural. Such as a mixture in mountain caverns of alum and nitre, which, becoming ignited, emit a sudden cloud, which, on penetrating to the middle region of the atmosphere, is then dissolved into rain.*

There are many instances quoted, and worthy of credit, of the praise of victory having been often deservedly assigned to men. Ollerus by magic art became a distinguished warrior amongst the Swedes, and was looked upon as a divinity, if we credit Saxo Grammaticus, who thus writes of Oddo, the Danish pirate. Without a ship, wandering o'er the ocean, he often defeated hostile fleets by rousing by his charms the fury of the elements against those enemies of the merchant and agriculturist.

Of the remarkable victory of the Tartars over the Poles, Cromerus writes in the following words:—"In the year 1240 of the Christian era, the Poles gave battle to the Tartars near Legnica, broke their lines by their impetuous charge, and drove them to flight, pressing closely on their rear. In the outmost rank of the Tartar host, amidst the other standards, was an ensign remarkable for the display of the figure and crest of the bearer. On the staff of the ensign was the figure, terrific and black, of a human head with shaggy beard. This ensign, when vehemently shaken by the bearer, exhaled a smoke and cloud, very thick and foul; and this cloud not only shrouded the barbarians from the vision of the Poles, but it also plagued them with their sickening odour."

It has also happened that clever men have employed the marvellous to escape from a critical situation, by imposing on the people. The following instances are from Kircher, in his 'Artis Magnæ Lucis et Umbræ':—

I know that many of our fathers have been rescued from the most imminent dangers amongst the barbarians of India by such inventions. These were cast into prisons, and whilst they continued ignorant of any means of effecting their liberation, some one, more cunning than the rest, invented an extraordinary machine, and then threatened the barbarians, unless they liberated his companions, that they would behold in a short time some extraordinary portents, and experience the visible anger of the Gods. The barbarians laughed at the threat. He then had constructed a dragon of the most volatile paper, and in this he enclosed a mixture of sulphur, pitch, wax, and so artistically prepared all his materials, that, when ignited, it would illumine the machine, and exhibit the following legend in their vernacular idiom, *The Anger of God.* The body being formed and the ingredients prepared, he then affixed a long tail, and committed the machine to the heavens, and, favoured by the wind, it soared aloft towards the clouds. The spectacle of the dragon, so brilliantly lit, was terrific. The barbarians, beholding the unusual motion of the apparition, were smitten with the greatest astonishment, and now, remembering the threatened anger of the Deity and the words of the father, they were in fear of expiating the punishment he had prognosticated for them. Therefore, without delay, they threw open the gates, they suffered their prisoners to go forth in peace and enjoy their freedom. In the mean time the fire seized on the machine and set it in a blaze, and with an explosion, which was interpreted as an expiring declaration of satisfaction, it, apparently of its own accord, vanished from sight, as if it had accomplished its supernatural mission. Thus the fathers, through the apprehension which this natural manifestation inspired, obtained that which could not be purchased with a large amount of gold.

Froissart tells us that, A.D. 1383, the Count of Bourgogne, wishing to capture a citadel near Naples, a magician came to one of the chiefs of his army, and promised to take it by means of a cloud, that would serve as a bridge, on which his soldiers could stand and descend to the summit of the walls; and that the besieged would be so alarmed, that they would surrender at discretion. He talked in such a strange way that he was looked upon as a man possessed by the devil; and when the particulars were detailed to the Count, he ordered him to be put to death.

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* Note by Rozier. "Par la raison que le sec attire l'humide et qu'une semblable nuée composée de parties chaudes et raréfiées, doit attirer à elle toute l'humidité de l'air environnant et que bientôt gonflée et comme engrossée par les courans d'air qui viennent se jeter dans elle, elle se condense, et acquiert une pesanteur qui doit la forcer de retomber."

In two histories by Jef le Ministre and De Colonia, of the town of Lyons, the following account is given :—

Towards the end of Charlemagne's reign, certain persons who lived near Mount Pilate in Switzerland, knowing by what means pretended sorcerers travelled through the air, resolved to try the experiment, and compelled some poor people to ascend in an aerostal. This descended in the town of Lyons, where they were immediately hurried to prison, and the mob desired their death as sorcerers. The Judges condemned them to be burned; but the Bishop Agobard suspended the execution, and sent for them to his palace, that he might question them. They answered, "Qu'ils sont du pays même, que des personnes de considération les ont forcés de se laisser conduire, leur promettant qu'ils verroient des choses merveilleuses; et qu'ils sont veritablement descendu par l'air." Agobard, though he could not believe this fact, gave credence to their innocence, and allowed them to escape. On this occasion he wrote a work on the superstition of the time, in which he demonstrated *the impossibility of rising in the air;* that it is an error to believe in the power of magic; and that it has its existence in the credulity solely of the people.

It was during the pontificate of Boniface VIII. that the miracle of Loretto occurred. The house inhabited by the Virgin immediately after her conception, had been converted, on the death of the Holy Family, into a chapel, and St. Luke had presented to it an image, carved by his own hands, still known as our Lady of Loretto. Some angels, chancing to be at Nazareth when the Saracen conquerors approached, fearing that the sacred relic might fall into their possession, took the house bodily in their hands, and, carrying it through the air, after several halts, finally deposited it at Loretto, in Italy.—DRAPER'S *Intellectual Development of Europe.*

SORCERIES.

**A.** A Witch.
**B.** A Spirit raised by the Witch.
**C.** A Friar raising his Imps.

Let warlocks grim, an' wither'd hags
Tell how wi' you, on ragweed nags,
They skim the muirs an' dizzy crags
Wi' wicked speed
And in kirk-yards renew their leagues
Oure howkit dead.—BURNS.

**D.** A Fairy Ring.
**E.** A Witch rideing on the Devill through the Aire.
**F.** An Inchanted Castle.

We come next to an eminent Englishman, Roger Bacon (born at Ilchester, 1214), who, for his genius and ability, was styled the "Admirable Doctor." He is the first to whom we are indebted for an approximation to the true principles of Aerostation. We here borrow the words of Wise (the American historian of Aerostation):—

He wrote upon various subjects, and displayed in all a great power of imagination, with an equal degree of enterprise. The knowledge he possessed, and the theories he laid down, appear the more remarkable, because we have, within the last hundred years, realised several of his most magnificent schemes. Like Franklin, his ideas and knowledge were three or four centuries ahead of the age he lived in. The art of sailing in the air, or, at least, the principle by which it is accomplished, seems to have been so well understood by him, that we may safely ascribe to him the discovery of its main principle (atmospheric buoyancy), which we shall presently perceive.

In one of his works,* he descants, in glowing language, on the possibility of constructing engines of immense size and power, that could traverse the land and the water with great speed, and carry with them persons and merchandise. He then goes on to describe a plan of navigating the air. He assumes that the atmosphere is a material of some consistency, capable of bearing upon its *surface* vessels, like ships are borne upon the surface of the water. He next describes the construction of his aerial machine, "which," he says, "must be a *large hollow globe* of copper, or other suitable metal, wrought extremely thin, in order to have it as light as possible. It must then," he says, "be filled with 'ethereal air or liquid fire,' and then launched from some elevated point into the atmosphere, where it will float like a vessel on water." It cannot be ascertained, from the writings of Roger Bacon, that he ever realised any of his grand projects of flying, by actual experiment; but, in concluding his treatise upon this branch, he expresses himself thus: "There is certainly a flying instrument, not that I ever knew a man that had it, but I am particularly acquainted with the ingenious person who contrived it."

After expressing himself so confidently upon the "hollow globe" method, he thinks, "There may be made some flying instrument, so that a man sitting in the middle of the instrument, and turning some mechanism, may put in motion some artificial wings which may beat the air like a bird flying."

To these descriptions of Bacon, some of our modern writers have adverted with greater zeal than judgment, to prove that the art of flying by human contrivances was known to the ancients, or, at least, anterior to the discovery of the Montgolfiers. They contend that Roger Bacon was well acquainted with the properties of the atmosphere. Some very learned disquisitions have been written to prove that his *ethereal air* and *liquid fire* were the same as our rarefied air and hydrogen gas.

With all due deference to the brilliant genius and far-reaching intellect of Roger Bacon, it must still be evident from his own writings that he did not fully understand the principle of atmospheric pressure, or he would not have thought it necessary to get his "hollow globe" on the surface of the atmosphere. As to his having some knowledge of the consistency of the air as an elastic fluid, that will not be denied, for, at that period, the attention of the learned began to be directed to the science of pneumatics; but we have no authenticated writings to show that they had a knowledge of the various and distinct gases.

The discovery of the art of making gunpowder has been attributed to Roger Bacon, and history makes it evident that he accomplished astonishing things in his day, for we read that he was accused of holding communion with the devil, and that the perusal of his writings was interdicted by an order of Nicolas IV., and the Doctor placed under personal restraint, where the emanations of his brilliant mind could only enlighten the emperor and his courtiers. Soon after Bacon's time, projects were instituted to train up children from their infancy in the exercise of flying with artificial wings, which seemed to have been the favourite plan of the flying philosophers and artists of that day. If we credit the accounts of some of their experiments, it would seem that considerable progress was made in that way. The individuals who used the wings could skim over the surface of the earth with a great deal of ease and celerity. This was accomplished by the combined faculties of running and flying. It is stated that, by an alternately continued motion of the wings against the air, and the feet against the ground, they were enabled to move along with a striding motion, and with incredible speed.

'Notes and Queries' of September 5, 1864, contains the following interesting answer to a

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* 'Epistolæ Fratris Rogeri Baconis, de Secretis operibus Artis et Naturæ, et de Nullitate Magiæ.' Paris, 1542.

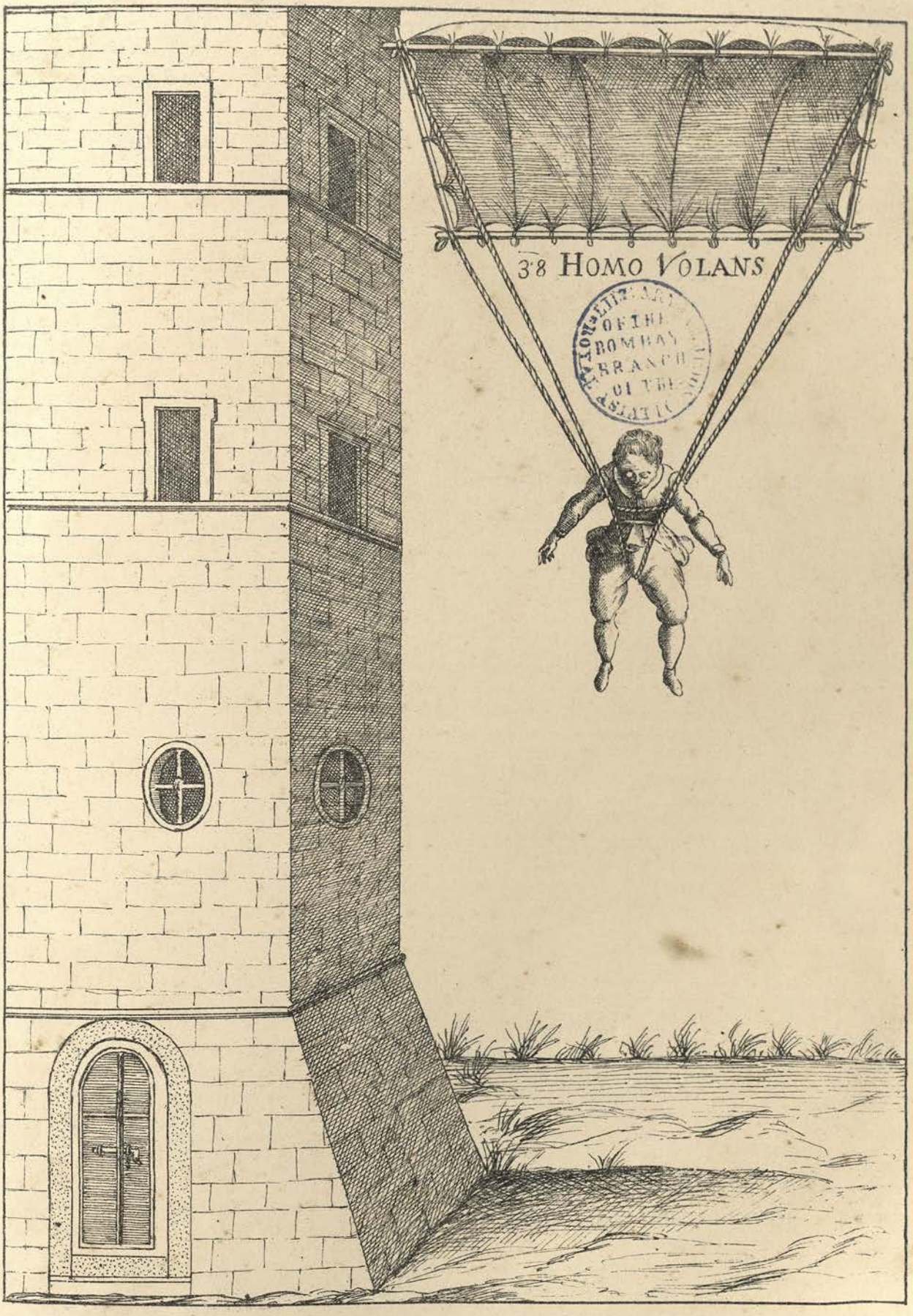


Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H. Heisham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director.

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query, the substance of which is given in the extract of the letter of 1607, that had been referred to :—

The passage, supposed to relate to a discovery of aërostation as early as 1607, is very short, and for the sake of clearness may be here repeated :—

" Sept. 27, 1607.

" The greatest newes of this countrie is of an ingenious fellow, that in Barkeshire sailed or went over a high steeple in a boat, all of his owne making ; and, without other help then himself in her, conveyed her above twenty miles by land over hills and dales to the river, and so down to London."

Now in 1606 the celebrated Peirescius (Nicolas Uande Fabri de Peiresc) came with the French Ambassador to England, was graciously received by King James, and having gone to Oxford, and visited Camden, Sir Robert Cotton, Sir Henry Saville, and other literary men, went over to Holland. While there he travelled to Sceveling for the purpose of seeing a sailing chariot lately made under the direction of the celebrated mathematician and mechanist Simon Stevinus. Peirescius was much struck with the invention, and, according to Gassendus (' Vita Peireskii,' lib. ii.), he used to describe the astonishment with which he was hurried along, driven by a rapid wind, which was yet not perceived by those in the chariot, for they went as fast as the wind itself.

" Commemorare solebat stuporem quo correptus fuerat, cum vento translatus citatissimo non persentiscere tamen, nempe tam citus erat quam ventus."

Peirescius describes the sailing chariot as going from Sceveling to Putten, about forty-two English miles, in two hours. Another contemporaneous writer, Walceius, describes the carriage as carrying six or ten persons a distance of twenty or thirty *German* miles in a few hours, with far greater speed than the swiftest ship on the sea, being completely under the easy command of the man at the helm.

It is known that Peirescius was obliged, by family affairs, to return to Paris in September 1606 ; and thus the striking invention, or possibly application of a kind of locomotive used before in China, and even in Spain, would be made known to his literary and scientific friends in France and in England.

Grotius celebrated the ingenuity of Stevinus in two epigrams. The fifth epigram contained in his ' Poemata ' is as follows :—

" Imposuit plaustro vectantem carbasa navim ?
An potius navi subdidit ille rotas ?
Scandit aquas navis : currus ruit aere prono :
Et merito dicas, ' Hic volat, illa natat.' "

In his fifteenth epigram he pays a graceful and elegant tribute to Stevinus, after the Roman fashion, a reference being made, in the second line, to the celestial constellation, Argo Navis :—

" Ventivolum Tiphys deduxit in æquora navim :
Jupiter in stellas ætheriamque domum :
In terrestre solum virtus Stevinia : nam nec,
Tiphy, tuum fuerat, nec Jovis istud opus."

The success of the experiment in Holland at least as early as September 1606, was likely to produce imitators in England as early as September 1607 ; and " the ingenious fellow in Barkeshire " appears to have been one. He conveyed " a boat all of his owne making," " above twenty miles *by land*, over hills and dales,"—upon one of which hills he might well be over, or above, " a high steeple " in a dale—and so arriving at the river, might proceed to London by water in his boat, detached from its temporary wheels.

That it is possible for a wheeled carriage driven by sails, to pass over uneven ground, was experimentally proved about the year 1820, when such a carriage travelled along the turnpike-road from Great Chesterford to Newmarket, a distance of about fifteen miles, over some considerable hills, at the rate, it is said, of about thirteen miles an hour. The writer of this reply saw that sailing carriage in motion on Newmarket Heath. It was cutter-rigged, with a fore-and-aft mainsail and triangular fore-sail. It carried several persons ; worked easily to windward, coming up to the wind and tacking as readily as a boat on the water ; and its speed was then such as to keep a horse at a moderate canter in order to accompany it.

It would thus appear that the above passage has probably no reference to aërostation. If such a discovery had been made at the beginning of the seventeenth century, it never could have been lost. We should have found allusions to it in Bp. Wilkins's ' Discourse concerning the Possibility of a Passage to the World in the Moon,' 1638, and in his ' Mathematical Magic,' 1648. Yet, while that daring and most original thinker describes

at length Stevinus's sailing chariot, and discusses several means by which flight might be effected mechanically, he makes no mention of a balloon, or any similar means of rising in the air. He does not appear to be acquainted even with the theoretical notion of his contemporary, the Jesuit Lana, who proposed to exhaust hollow balls of metal, and thus to render them specifically lighter than the atmosphere, forgetful that such balls would be crushed by the enormous pressure of the external air, unsupported by a fluid within.

Wilkins, Bishop of Chester, who died in 1672, had read many of the foregoing quotations, and wrote a work named 'Dædalus; or, Mechanical Motions,' in which he embodies the sentiments and principles of Roger Bacon on this subject, giving, however, quainter illustrations, to show that the atmosphere is navigable. Man now erred by attempts to imitate the flight of birds, and from a lack of empirical knowledge with regard to the laws of heat and gases, which remained an enigma till revealed by the experiments of Priestley and Cavendish, about the middle of the eighteenth century. We may here notice, that "*in tracing the progress of knowledge in relation to atmospheric buoyancy, it exhibits to the mind a very striking exemplification of the nearness with which we may approach to the desired object of our pursuits, and yet, for the want of knowing correctly the application of a trifling part of it, how long we may be baffled in perfecting our schemes.*" *

Bishop Wilkins thus succinctly speaks of the several ways by which "flying hath been or may be attempted":—

"1st. By spirits or angels.
2nd. By the help of fowls.
3rd. By wings fastened immediately to the body.
4th. By flying chariots."

This appears much the order in which we read of them in history.

"By spirits and angels." Instances occur in the Bible; and, if we could believe spiritualists, this is again revived.

"By the help of fowls." As related in Persian and other Oriental tales; of which the following is a good sample, from a manuscript in the British Museum:—

'Translation of the relation of the Aerial Voyage of Kai Kaoos, King of Persia, the Cyaxares of the Greeks, from the Persian of Ferodosee, the Shah-Nameh, or King-Book, written in the tenth century.'

"To the king it became a matter of great concern how he might be enabled to ascend "the heavens, without wings; and for that purpose he consulted the astrologers, who "presently suggested a way in which his desires might be successfully accomplished.

"They contrived to rob an Eagle's nest of its young, which they reared with great care, "supplying them with invigorating food.

"A Frame of Aloes-wood was then prepared and at each of the four corners was fixed "perpendicularly a javelin, surmounted on the point with the flesh of a goat. At each corner "again one of the eagles was bound, and in the middle the king was seated with a goblet of "wine before him. As soon as the eagles became hungry they endeavoured to get at "the goat's flesh upon the javelins, and by flapping their wings, and flying upwards

* Wise, 'History of Aeronautics.'

" they quickly raised the throne from the ground. Hunger still pressing on them, and still " being distant from their prey, they ascended higher and higher in the clouds, conveying the " astonished king far beyond his own country. But after a long and fruitless exertion their " strength failed them, and unable to keep their way the whole fabric came tumbling down " from the sky, and fell upon a dreary solitude in the kingdom of Chin :—where Kai Kaoos " was left a prey to hunger, alone, and in utter despair."

KAI KAOOS, THE PERSIAN KING.

The tales of the Roc in the 'Arabian Nights,' and also the wondrous Ganzas, are familiar to us, and, only a century ago, were still believed in England.*

Automata were then devised, and the human mind speculated for centuries on "fastening wings to the body"; or even, like Archytas in the fourth century before the Christian era, in making a dove. Two or three instances will suffice.

* *Cardan* and *Scaliger* doe unanimously affirm, that there is a bird amongst the Indians of so great a bignesse, that his beak is often used to make a sheath or scabbard for a sword. And *Acosta* tels us of a fowl in *Peru* called *Condores*, which will of themselves kill and eat up a whole calf at a time. Nor is there any reason why any other body may not be supported and carried in the air, though it should as much exceed the quantity of these fowl as they do the quantity of a flie. Marcus Polus mentions a fowl in Madagascar which he cals a Ruck, the feathers of whose wings are 12 paces, or threescore foot long, which can with as much ease soop up an elephant as our kites do a mouse. If this relation were anything credible, it might serve as an abundant proof for the present quære. —WILKINS, Bishop of Chester, 1660.

'Tis related of a certain English monk (Elmerus) in the reign of the Confessor, that he did by such wings fly from a tower above a furlong; and so another from St. Mark's steeple at Venice; and Busbequius speaks of a Turk at Constantinople who attempted something this way. Burton (in his 'Anatomy of Melancholy'), mentioning this quotation, doth believe that some new-fangled wit ('tis his cynical phrase) will some time or other find out this art. In the beginning of the tenth century an Italian adventurer visited Scotland, during the reign of James IV., and, being a man of some address, and at the same time a pretender to alchemy, he contrived to insinuate himself into the favour of that gay and needy prince, by holding out hopes of augmenting his scanty treasury by the acquisition of the philosopher's stone.

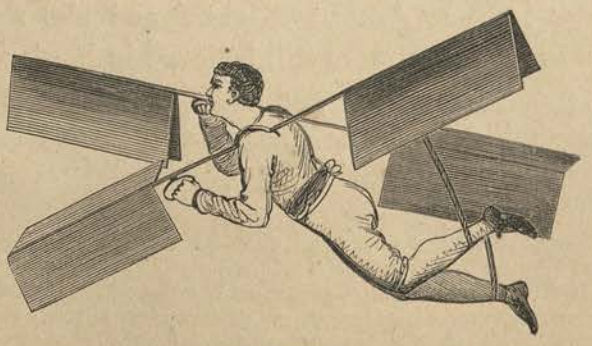
He was collated by royal favour to the abbey of Tungland (or Tongland), in Galloway; but, not having succeeded in creating artificial riches, he resolved, in the height of his enthusiasm, at once to gratify and astonish the courtiers by the display of a feat still more extraordinary.

Having constructed a set of ample wings, composed of various plumage, he undertook to fly through the air from the walls of Stirling Castle to France. This experiment he had actually the folly and hardihood to try, but soon came to the ground, and broke his thigh-bone by the violence of the fall. For this unlucky failure, however, the abbot had the dexterity to draw a very plausible excuse from the wretched sophistry termed science, in that age.

"My wings," said the artful Italian, "were composed of various feathers. Among them "were the feathers of dunghill fowls, and, by a certain sympathy, were attracted to the "dunghill; whereas had my wings been composed of eagles' alone, the same sympathy would "have attracted them to the region of the air."

Like attempts were made at Tübingen and Vienna; and, in the reign of Louis XIV., the noble terrace of St. Germain en Laye witnessed the rope-dancer Allard's endeavour to fly across the Seine to Vesinet; but, falling at the bottom of the wall, he broke a limb.

Roger Bacon, Lauretus Laurus, Schottus, Cardan (already quoted), and Scaliger, gave countenance to such experiments; and it was not till Borelli published his celebrated work, 'De Motu Animalium,' in 1670, showing by accurate calculations the prodigious force which the pectoral muscles of birds must exert and maintain, that these projects were abandoned, except by a few. The most remarkable of these attempts appeared in the 'Journal des Savans,' 12th September, 1678, when a Mons. Besnier, of the province of Maine, tried the experiment, represented in the following woodcut:—



M. Besnier.

" Ces ailes sont chacune un châssis oblong de taffetas, attachées à chaque bout de deux bâtons que l'on ajustait sur les épaules. Ces châsses se pliaient du haut en bas comme des battant de volets brisés. Ceux de devant étaient remués par les mains, et ceux de derrière par les pieds, en tirant chacun une ficelle qui leur était attachée."

The inventor did not pretend that he could rise from the earth, or sustain himself long in the air with them, from the inability to give his apparatus the required power and rapidity; but he availed himself of their aid in progressively raising himself from one height to another until he reached the top of a house, from the roof of which he passed over the neighbouring houses. By thus leaving an elevated position, he could cross a river of considerable breadth, or any other obstacle. His first pair of wings were purchased by a Mr. Baldwin, of Guibre, who, it is said, used them with remarkable success. And finally Blanchard, of whom we shall hear more hereafter, wrote thus to the 'Journal de Paris:'—" Je rends donc, à l'occasion de sa première ascension en ballon au Champ-de-Mars, le 2 Mars, 1784, un hommage pur et sincère à l'immortel Montgolfier, sans le secours duquel j'avoue que le mécanisme de mes ailes ne m'aurait peut-être jamais servi qu'à agiter un élément indocile qui m'aurait obstinément repoussé sur la terre comme le lourd autruche, moi, qui comptais disputer à l'aigle le chemin des nues."

We again quote from Mr. Wise:—

The philosophers, from Bacon's time down to the discovery of the true nature of atmospheric pressure, as illustrated by the Torricellian tube, and air-pump, in their speculations upon aerial navigation, all had an opinion that the atmosphere had a defined limit or border, not very high above the earth, upon which the aerial vessel must necessarily be placed in order to have it buoyed up by the air underneath, like the water under a ship. Reasoning from their knowledge of hydrostatics, they took it for granted that the atmosphere was a vast ocean of air surrounding our globe, upon the outer border of which rested another ethereal ocean of a much rarer kind, separate and distinct as the air rests upon the water. Still they approached nearer, in each succeeding generation, to an attainment of navigating the air. Judging, then, from the scanty knowledge they possessed of pneumatics, and indeed of all the sciences, they are entitled to a great deal of credit, in regard to the art of aerial navigation, as also to other important subjects. 'It does seem that, if the progressive individuals of our generation were to apply themselves with the same earnestness to this subject now, that those did before us whom we have made reference to, it would not be long before we should see air travelling as much preferred and in advance of steamboat and railroad travelling, as the latter are now in advance of the old-fashioned stage-coach and schooner method. In the course of our history, we shall see that the discovery by the Montgolfiers created a spirit for its advancement so far beyond a legitimate end, that we may ascribe to it much of the apathy that has followed it. At the present time, there is, however, a new and sober determination growing up again in the way of improving this neglected art.

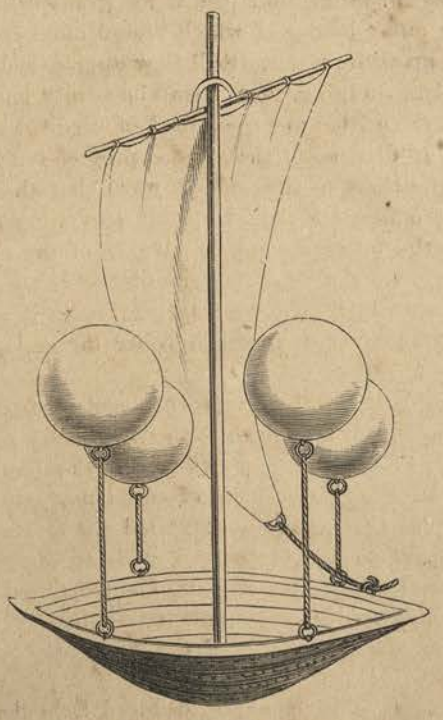
The great interest that was manifested in the seventeenth century from the numerous experiments that were going on in every civilised part of the world, brought into the field many able writers on this subject, which soon revived all the knowledge and history of the past, and created a fresh stimulus to the investigation of all subjects that had any bearing on, or relation to, the improvement of aerial navigation. Hypothetical narrations had now to give way to the more solid principles that naturally suggested themselves under such a state of improvement. Mathematical demonstration was resorted to as the only sure guide to direct the progress of the arts, and thus the veil of mystery could no longer cover the vague pretensions of monopolised learning. The researches of alchemy had also contributed many valuable discoveries towards strengthening the rational philosophy of the day. And from about this period we date the beginning of the most important and useful improvements in the operations of mankind.

Francis Lana, a Jesuit, and a very judicious writer, deduced from the new discoveries the real nature and pressure of the atmosphere, and is the first who established a theory verified by mathematical accuracy, and clearness of perception, which placed him far in advance of his predecessors in the science of aerial navigation. He very truly inferred that a vessel exhausted of air would weigh less than when full of that fluid. He also shows in his problems that the capacity of globular vessels increases much faster than their surfaces. For

example, two globular vessels, one of ten feet diameter, and another of twenty feet diameter; the first will have a capacity of 523 cubic feet and a fraction over, while the other will have 4189 cubic feet. The surface of the larger is four times that of the smaller, while its capacity, or contents, is eight times as great. This is a very important consideration in the construction of balloons. Thus, a balloon that would carry one person, would weigh one hundred pounds, which is about the weight of such a one, and would cost between 40*l.* and 50*l.*; one capable of carrying two persons would not cost more than between 60*l.* and 70*l.*, and would not weigh more than one hundred and fifty pounds. Now, a balloon of the power first mentioned would be about twenty feet in diameter, which, when filled with ordinary hydrogen gas, would have an ascending power of two hundred and fifty pounds, while one of five times its diameter, being one hundred feet, would have an ascending power of thirty-two thousand seven hundred and twenty-five pounds, which would be capable of carrying one hundred and sixty-six men, independent of its own weight and necessary appendages.

Lana proposed to prepare four hollow globes of copper, each twenty feet in diameter, and so thin, that they would weigh less than an equal bulk of atmosphere, when they were exhausted of air. To these globes he designed fastening a boat, in which the aeronaut and his appendages were to be stationed, for the purpose of directing the machine. Although the idea laid down here involves the same principles by which aeronautics are practised at the present day, still, several obstacles present themselves which must have rendered his plan impracticable. The copper, of which the balloons were to have been made, must necessarily have been so thin, to make the vessels light enough, that they would not have been strong enough to resist the external pressure of the atmosphere when they were exhausted.

The barometer, by which the pressure of the atmosphere is ascertained, was discovered in 1643. The weight of the air, as shown by the Torricellian tube, being about fifteen pounds to every square inch of surface, was no doubt the stimulus to Lana's proposition of the copper globes. His work, entitled 'Prodromo dell' Arte Maestra Brecia,' in which he describes his machine, appeared in 1670, while the air-pump was not invented, or at least its invention not made known, until the year 1672. The great pressure of the air, as shown by the barometer, without a knowledge of its specific gravity, would very naturally induce a belief that it possessed a much greater weight than it really has, which is one and two-tenth ounces to the cubic foot. Had Lana known the exact pressure and specific gravity of the air, his mathematical knowledge would have at once convinced him of the impracticability of his machinery.



Jesuit Father Lana's Proposition.

A letter dated Lisbon, the 10th of February, was published soon after in some of the scientific journals of Paris, containing with it the copy of an address presented to the King of Portugal, in the year 1709, by

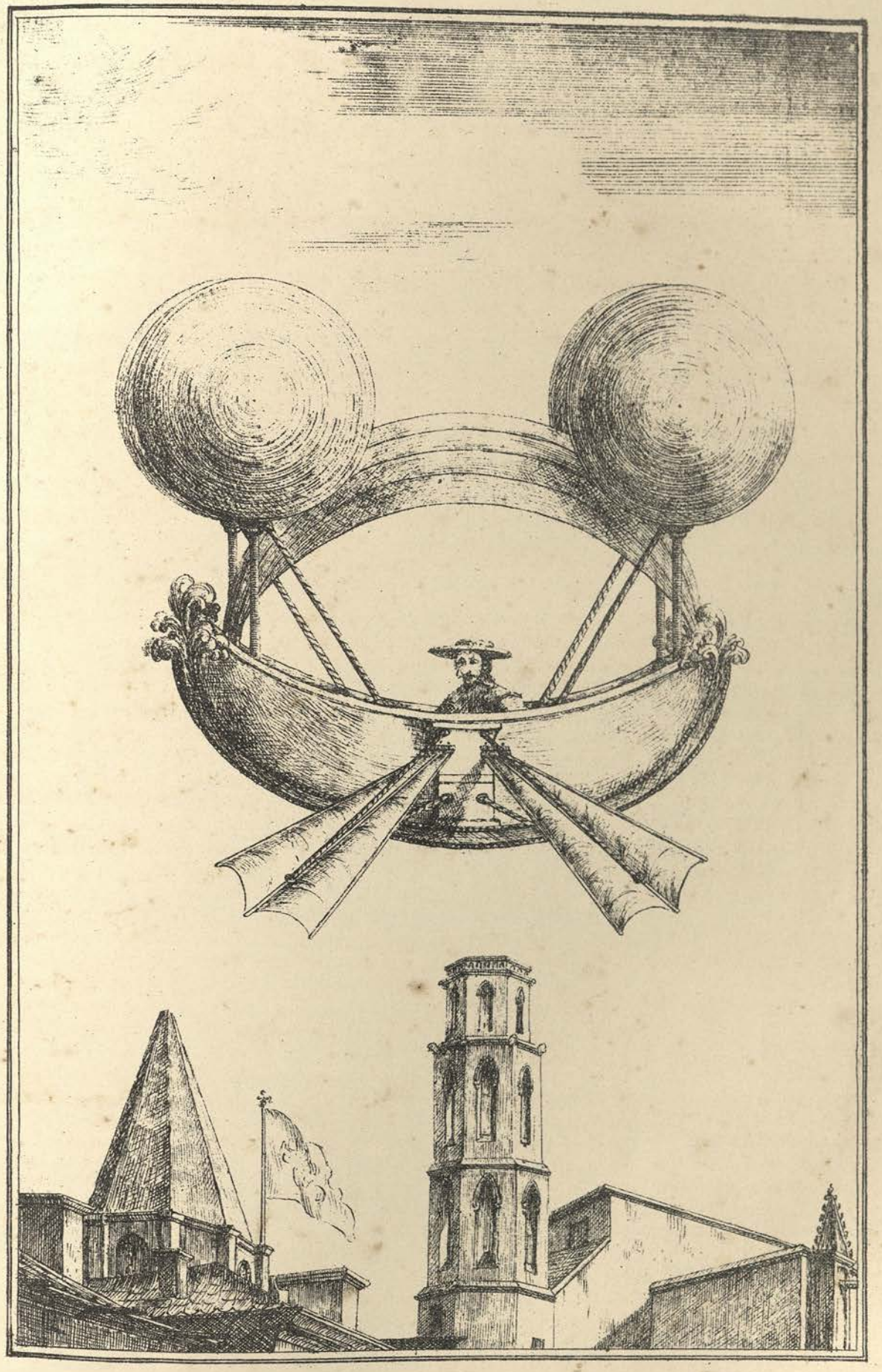


Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Holsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director.

1864

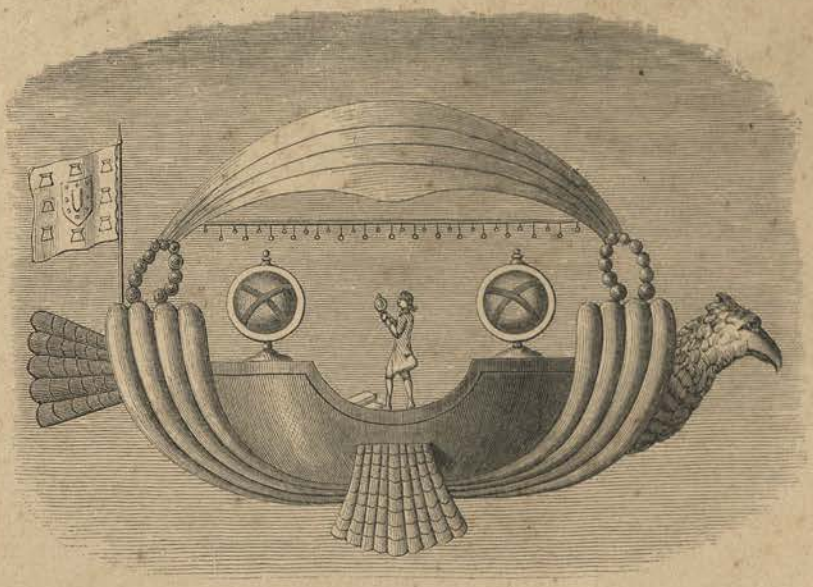
a friar called Bartholomew Laurence de Gusman. In this the petitioner represents himself as having invented a flying machine, capable of carrying passengers, and navigating through the air very swiftly. He also requests the privilege of being the sole possessor of the invention, desiring a prohibition against all and every person from constructing a similar machine under a severe penalty. Upon this the king issued the following order in his favour:—

"Agreeably to the advice of my council, I order the pain of death against the transgressor. And, in order to encourage the suppliant to apply himself with zeal towards improving the machine which is capable of producing the effects mentioned by him, I also grant him the first Professorship of Mathematics in my University of Coimbra, and the first vacancy in my College of Barcelona, with the annual pension of 600,000 reis during his life.

"The 17th day of April, 1709."

It is said notwithstanding that, through the influence of the Inquisition, he was thrown into prison.

Father Galien, of Avignon, published a work called 'L'Art de Naviguer dans les Airs in 1755, when the force of general superstition, that still imputed all flights in the air to demons or magicians, obliged him to qualify it with the additional title of 'Amusement Physique et Géométrique.' It contained a wild scheme of ascending mountains, and enclosing the light ethereal air found at such altitudes, in constructions of canvas or cotton; while the machine he had the boldness to project and minutely describe, was about ten times the size of Noah's ark, and could have lifted the whole town of Avignon, where he resided.



THE PORTUGUESE EXPERIMENT.

## THE FLIGHT OF IMAGINATION.

* * * The high-born soul
Disdains to rest her heaven-aspiring wing
Beneath its native quarry. Tired of earth
And this diurnal scene, she springs aloft,
Through fields of air: pursues the flying storm;
Rides on the volleyed lightning through the heavens;
Or, yoked with whirlwinds and the northern blast,
Sweeps the long tract of day. Then high she soars
The blue profound, and hovering round the sun,
Beholds him pouring the redundant stream

Of light; beholds his unrelenting sway
Bend the reluctant planets to absolve
The fated rounds of Time. Thence far effused
She darts her swiftness up the long career
Of devious comets; through its burning signs
Exulting measures the perennial wheel
Of Nature, and looks back on all the stars,
Whose blended light, as with a milky zone,
Invests the orient. Now amazed she views
The empyreal waste, where happy spirits hold,
Beyond this concave heaven, their calm abode;
And fields of radiance, whose unfading light
Has travelled the profound six thousand years,
Nor yet arrives in sight of mortal things.
Even on the barriers of the world untired,
She meditates the eternal depth below;
Till, half recoiling, down the headlong steep
She plunges; soon o'erwhelmed and swallowed up
In that immense of being. There her hopes
Rest at the fated goal. For from the birth
Of mortal man, the sovereign Maker said,
That not in humble nor in brief delight,
Not in the fading echoes of renown,
Power's purple robes, nor Pleasure's flowery lap,
The soul should find enjoyment; but from these,
Turning disdainful to an equal good,
Through all the ascent of things enlarge her view,
Till every bound at length should disappear,
And infinite perfection close the scene.

—Mark Akenside, 1744.

The Art of Flying Burlesqued.

# CHAPTER III.

## 1783–5.

ΤΗΕΡΝΕΦΗΣ; OR, MONTGOLFIÈRES AND CHARLIÈRES, AND THE TWO YEARS OF UNINTERRUPTED SUCCESS.

Montgolfier nous apprit à créer un nuage.
Son génie étonnant, aussi hardi que sage,
Sous un immense voile enfermant la vapeur
Par sa capacité détruit la pesanteur.
Notre audace, bientôt, en saura faire usage,
Nous soumettrons de l'air le mobile élément,
Et des champs azurés le périlleux voyage
Ne nous paraîtra plus qu'un simple amusement.

THE MONTGOLFIER FAMILY — THE INVENTION AT ANNONAY — THE INSTITUTION OF THE "DERBY," AND THE DISCOVERY OF THE COMPOSITION OF WATER — THE EXPERIMENT AT PARIS — "A PATERNAL GOVERNMENT" — TIBERIUS CAVALLO — "A SHEEP, A COCK, AND A DUCK" — "EXPERIMENTS" — "HONOURS TO MONTGOLFIER" — TO ΠΡΩΤΟΠΤΗΜΑ — COUNT ZAMBECCARI IN LONDON — WOOLWICH TO PETWORTH — THE CHARLIÈRE — "HONOURS TO CHARLES" — EXPERIMENTS AT PHILADELPHIA, U.S. — SEVEN PEOPLE ASCEND AT LYONS — THE FIRST PILOT BALLOON ACROSS THE CHANNEL — PAUL ANDREANI AT MILAN — JEAN-PIERRE BLANCHARD — THE ASCENT OF FOUR LADIES — MADAME THIBLE, THE FIRST LADY TO ASCEND IN A FIRE-BALLOON — DUKE DE CHARTRES — LUNARDI — AN ITALIAN'S VIEW OF ENGLISH SOCIETY — CHELSEA HOSPITAL — THE ARTILLERY GROUND — "THE PRINCE OF WALES" — THE FIRST ASCENT IN ENGLAND — "ENGLISH LAW" — THE 'MORNING POST' OF SEPT. 16TH, 1784 — THE DESCENT AT WARE, IN HERTFORDSHIRE — PRESENTATION TO THE KING — DEPOSITIONS — A WELL-KNOWN GENTLEMAN IN THE LITERARY WORLD — A VOYAGE OF ONE HUNDRED AND FIFTY MILES — SECOND AERIAL VOYAGE IN ENGLAND — ASCENT FROM OXFORD — BLANCHARD JEFFERIES CROSSES THE CHANNEL — SHAKSPEARE'S CLIFF — CALAIS — A MONUMENT ERECTED — GENERAL REMARKS.

THE inventors of the aerostat will be for ever remembered. Their family history is also of much interest. The Montgolfiers were natives of the small town of Ambert, in Auvergne. At the close of the last century there was still seen on the slope of the hill that overhangs the town the ruins of the ancient residence of the Montgolfier family; and they either gave their name to, or took it from, the surrounding country, as may be noticed in the old map by Cassini.

The oldest paper manufactories in France were established at Thiers and Ambert. The invention of this manufacture dates from a remote epoch; for in the time of St. Louis, the East, especially Damascus, supplied the world with paper. St. Louis mentions this in his letters to Joinville. Paper was then made from cotton, and was called "Carta Damascena."

There exist in the archives of the province of Auvergne, acts that speak of a paper manufactory at Ambert, in 1386. To its citizens belongs the glory—more especially to one Montgolfier (whose name signifies the Master of the Mountain)—of introducing this manufacture into France, on their return from the sixth, and last Crusade, when, according to historians, a great number of "Auvergnats" were made prisoners of war. During that

long captivity they had become acquainted with the manufactories of Damascus. Soon after setting up the mills in their native town, they found rags were as good for the purpose as the new cotton exclusively used in the East.

From the annals of Ambert, it appears that a Montgolfier was the "barege," or mayor, of that town in 1440.

Paper at this time was only used for writing; but the invention of cards, in the reign of Charles VI., increased its consumption.

Michel Montaigne speaks of this manufacture when passing through Thiers on his return from Italy, "Il y a autant de façons à cela, dit-il, qu'à une autre bonne besogne; les cartes ne se vendent qu'un sou les communes, et les fines deux." Later, when printing (that triumph of written thought) was discovered, the manufactories of Auvergne found a new demand for their products, and flourished accordingly.

In 1533, when Luther and Calvin preached, a great number of "Auvergnats," and among others Montgolfier, ardently embraced the reformed religion. The Montgolfier of this generation was one of the most zealous Protestants, and, at his own expense, he sent to Geneva for *ministers of the Gospel.* His zeal brought on himself and his family a rigorous persecution. After the Massacre of St. Bartholomew (1572) his goods were confiscated, his paper manufactories destroyed, and he was obliged to fly. Montgolfier, with his family, took refuge in the mountains near Lyons, where he again introduced the manufacture of paper.

Towards the end of the seventeenth century there lived at Vidalon, near Annonay, at the foot of the mountains of Vivarais, a wealthy owner of a number of windmills, named Antoine Schelle. He had two daughters. Jean Montgolfier, paper manufacturer, of St. Didier sur Beaujeu, asked them in marriage for his two sons, Michel and Raymond. This double union was celebrated in January, 1693. The windmills were transformed into paper manufactories, and, under the direction of the brothers Montgolfier, these establishments became important, and at length attained the rank of a royal manufactory. In consequence of these marriages the greater part of the Montgolfier family came and lived at Annonay. Raymond Montgolfier had a large family, and among them Pierre Montgolfier, who was the father of the inventors of the Aerostat. He had already received many tokens of approbation from Louis XVI. when the brilliant discovery of his sons—to be mentioned presently—crowned his happiness.

The poet Boissy d'Anglas says of him :—

La gloire l'environne, et ses cheveux blanchis
S'embellissent encore des lauriers de ses fils.

The following letter-patent, which in chronological order should come in a little later, here shows the estimation in which the family was held :—

*Lettres-patentes données par le Roi Louis XVI^e. du nom, au Sieur Pierre Montgolfier, Decembre* 1783 :—

Louis, by the grace of God King of France and of Navarre, to all present and to come, greeting:

The aerostatic machines invented by the two brothers, the Sires Etienne-Jacques and Joseph-Michel Montgolfier, have become so celebrated, the experiment made before us on the 19th of September by the said Etienne-Jacques Montgolfier, and those that have followed, have had such success, that we have no doubt but that this invention will cause a memorable epoch in physical history; we hope also that it will furnish new means to increase the power of man, or at least to extend his knowledge.

Persuaded that one of our chief duties is to encourage persons who cultivate the sciences, and to show the effects of our good wishes to those who succeed in enriching them by happy discoveries, We have thought that this ought more especially to draw our attention to the two enlightened naturalists who share the glory of the discovery.

We have learnt that the Sire "Pierre Montgolfier," their father, is of an ancient and honourable family, and that having received from his ancestors a paper manufactory situated at Annonay, in Vivarais, he has rendered it by his care and intelligence one of the most important in the kingdom, so that 300 people are there employed. We are also informed that the said Sire "Pierre Montgolfier" was the first to make Vellum Paper, and that in 1780 the States of Languedoc, wishing to imitate the Dutch manufacture, intrusted to him the commission, by which he gave so much satisfaction, that many manufacturers copied his productions. These circumstances relating to the Sire "Pierre Montgolfier" are sufficient to place him among those large manufacturers who by their zeal, their activity, and their talents, can hope to receive the most flattering and distinguished honour we are able to accord—that of being raised to the rights and prerogatives of the nobility. But what has caused us to bestow it at once on the Sire "Pierre Montgolfier" is, that it may be (both) a reward worthy of the labours of the father and of the beautiful discovery of aerostatic machines, entirely owing to the knowledge and researches of his two sons.

For these causes, by our especial grace, full power, and royal authority, we have ennobled, and by these presents signed by our hand do ennoble the said Sire "Pierre Montgolfier," and we have honoured and do honour him with the title of Squire; and we wish and it pleases us that he be enrolled and addressed, as we have enrolled and addressed him, Noble, at all times, together with his children and descendants, male and female, born and to be born in legitimate marriage; that they may like him at all times and in all places be ranked as squires, and be enabled to arrive at all degrees of chivalry and other dignities, titles, and qualities, reserved for our nobility, that they shall be inscribed in the list of squires, and that they shall enjoy all rights, privileges, and prerogatives, that are reserved to them.

(Signed) Louis.

Par le Roi.

Le Baron de Breteuil.*

shout of joy rang through Europe, and reached the ear of the aged Euler† on the banks of the Neva, who, between attacks of vertigo, which were soon to carry him from this scene to a better, dictated to his sons the calculations he had made on Aerostatical Globes. It is said he ceased to calculate and live at the same instant.

The cause of so great enthusiasm had better be given in the accurate description that immediately circulated among the peoples:—

On Thursday, 5th June, 1783, the States of Vivarais being assembled at Annonay (36 miles from Lyons), Messrs. Montgolfier invited them to see their new aerostatic experiment.

Imagine the surprise of the Deputies and spectators on seeing in the public square a ball, 110 feet in circumference, attached at its base to a wooden frame of 16 feet surface. This enormous bag, with frame, weighed 300 lbs., and could contain 22,000 feet of vapour.

* Depuis Delcourt's 'Histoire d'Aerostats.'

† Euler (Leonard), born at Bâle 15th April, 1707; Professor of Mathematics; Member of the Imperial Academy of St. Petersburg; Ancient Director of the Royal Academy at Berlin; F.R.S., and Corresponding Member of the Royal Academy of France; the author of many works: died Sept. 1783. Condorcet says:—"Euler was one of those men whose genius was equally capable of the greatest efforts and of the most continued labour; who multiplied his productions beyond what might have been expected from human strength, and who, notwithstanding, was original in each; whose head was always occupied, and his mind always calm. The nature of his pursuits, by withdrawing him from the world, preserved that simplicity of manners for which he was originally indebted to his character and his education; and he employed none of those means to which men of real merit have sometimes recourse in order to enhance the importance of their discoveries."

Imagine the general astonishment when the inventors announced that, as soon as it should be filled with gas (which they had a simple means of making), it would rise of itself to the clouds. One must here remark that, notwithstanding the general confidence in the knowledge and wisdom of Messrs. Montgolfier, such an experiment appeared so incredible to those who were present, that all doubted of its success.

But Messrs. Montgolfier taking it in hand, proceed to make the vapours, which gradually swell it out till it assumes a beautiful form. Strong arms are now required to retain it; at a given signal it is loosed, rises with rapidity, and in ten minutes attains a height of 6000 feet; it proceeds 7668 feet in a horizontal direction, and gently falls to the ground.

Just as the Omnipotent, who turns
The system of a world's concerns,
From mere minutiæ can educe
Events of the most important use;
But who can tell how vast the plan,
Which this day's incident began?

The effect of this letter in England was to cause a display of jealousy at which we might now blush, if we do not remember that the sagacious and convincing views of Adam Smith on Political Economy had only just been published, and had not yet had time to circulate; for, though we were obliged to admit a discovery had been made in France, yet the periodicals argued that all the experiments that had led to it were made in England. Many were the caricatures which appeared, as will be noticed in a subsequent chapter.

Brisson, in his 'Dictionnaire Raisonné de Physique,' says, "Je ne fais que répéter, ce que le citoyen Montgolfier m'a affirme lui même lorsqu'il est venu à Paris annoncer sa découverte, la citoyenne Montgolfier, ayant placé un jupon sur un de ses paniers d'osier à claire-voie dont les femmes font usage pour sécher leur linge, le jupon fut élevé jusqu'au plancher. C'est de ce fait que sont partis les citoyens Montgolfier."

In a discourse at the Academy of Lyons, Montgolfier says that a French copy of Priestley's 'Experiments relating to the Different Kinds of Air' came in his way, and was to him like light in darkness; as from that moment he conceived the possibility of navigating the air, but, after some experiments in gas, he again tried smoke and hot air. This year, 1783, is not only memorable for this invention of the Montgolfiers, but also for the institution of the "Derby," and for the still more important discovery that Buckle, in his 'History of Civilisation,' thus relates:—

The only discovery made by Watt, was that of the composition of water. Though his claims are disputed by the friends of Cavendish, it would appear that he was the first who ascertained that water, instead of being an element, is a compound of two gases. This discovery was a considerable step in the history of chemical analysis, but it neither involved nor suggested any new law of nature, and has, therefore, no claim to mark an epoch in the history of the human mind. There is, however, one circumstance connected with it which is too characteristic to be passed over in silence. The discovery was made in 1783, by Watt, the Scotchman, and by Cavendish, the Englishman, neither of whom seems to have been aware of what the other was doing. But between the two there was this difference,—Watt, for several years previously, had been speculating on the subject of water in connexion with air, and having, by Black's law of latent heat, associated them together, he was prepared to believe that one is convertible into the other. The idea of an intimate analogy between the two bodies having once entered his mind, gradually ripened; and when he at last completed the discovery, it was merely by reasoning from data which others possessed besides himself. Instead of bringing to light new facts, he drew new conclusions from former ideas. Cavendish, on the other hand, obtained his result by the method natural to an Englishman. He did not venture to draw a fresh inference, until he had first ascertained some fresh facts. Indeed, his discovery was so completely an induction from his own experience, that he omitted to take into consideration the theory of latent heat, from which Watt had reasoned, and where that eminent Scotchman had found the premisses of his argument.

Both of these great inquirers arrived at truth, but each accomplished his journey by a different path. And this antithesis is accurately expressed by one of the most celebrated of living chemists, who, in his remarks on the composition of water, truly says, that while Cavendish established the facts, Watt established the idea.

In Paris this intelligence caused a meeting of *savans*, who, by the advice of Mons. Faujas de Saint Fond, started a public subscription for defraying the expense of making inflammable gas (hydrogen), the materials of which were expensive: 1000 lbs. of iron filings and 498 lbs. of sulphuric acid were consumed to fill a globular bag of varnished silk, which, for the first time, was designated a *Ballon*; or *Balloon*, as we call it, meaning a great ball.

The filling commenced on the 23rd of August, in the Place des Victoires. Bulletins were published daily of its progress, but, as the crowd was found to be immense, it was moved on the night of the 26th to the Champ de Mars, a distance of two miles. It was done secretly, and in the dark, to avoid a mob.

A description by an eye-witness is as follows:—"No more wonderful scene could be imagined than the Balloon being thus conveyed, preceded by lighted torches, surrounded by a 'cortége,' and escorted by a detachment of foot and horse guards; the nocturnal march, the form and capacity of the body, carried with so much precaution; the silence that reigned, the unseasonable hour, all tended to give a singularity and mystery truly imposing to all those who were unacquainted with the cause. The cab-drivers on the road were so astonished that they were impelled to stop their carriages, and to kneel humbly, hat in hand, whilst the procession was passing."

In the morning the Champ de Mars was lined with troops, every house to its very top, and every avenue was crowded with anxious spectators. The discharge of a cannon at 5 P.M. was the signal for ascent, and the globe rose, to the great surprise of the spectators, to a height of 3123 feet in two minutes, where it entered the clouds. The heavy rain which descended as it rose did not impede, and tended to increase surprise. The idea that a body leaving the earth was travelling in space was so sublime; and appeared to differ so greatly from ordinary laws, that all the spectators were overwhelmed with enthusiasm. The satisfaction was so great that ladies in the latest fashions allowed themselves to be drenched with rain, to avoid losing sight of the globe for an instant.

The Balloon, after remaining in the atmosphere three-quarters of an hour, fell in a field near Gonesse, a village fifteen miles from the Champ de Mars. The descent was imputed to a tear in the silk.

The effect on the inhabitants of this village well illustrates that the human character with an unawakened intellect is the same in all countries and ages:—

"For on first sight it is supposed by many to have come from another world; many fly; "others, more sensible, think it a monstrous bird. After it has alighted, there is yet motion "in it from the gas it still contains. A small crowd gains courage from numbers, and for an "hour approaches by gradual steps, hoping meanwhile the monster will take flight. At "length one bolder than the rest takes his gun, stalks carefully to within shot, fires, witnesses "the monster shrink, gives a shout of triumph, and the crowd rushes in with flails and "pitchforks. One tears what he thinks to be the skin, and causes a poisonous stench; again "all retire. Shame, no doubt, now urges them on, and they tie the cause of alarm to a "horse's tail, who gallops across the country, tearing it to shreds."

A similar tale has lately been told me as having occurred in Persia, where a fire balloon was let off by some French visitors to the Shah's palace at Teheran, when it alighted. No less than three shots were fired at it when on the ground, before any one would venture nearer.

It is no wonder, then, that the paternal government of France deemed it necessary to publish the following "avertissement" to the public:—

Paris, 27th August, 1783.

"*Avertissement au peuple*" on the ascent of balloons or globes in the air. The one in question has been raised in Paris this said day, 27th August, 1783, at 5 P.M., in the Champ de Mars.

A discovery has been made, which the Government deems it right to make known, so that alarm be not occasioned to the people.

On calculating the different weights of inflammable and common air, it has been found that a balloon filled with inflammable air will rise towards heaven till it is in equilibrium with the surrounding air; which may not happen till it has attained a great height.

The first experiment was made at Annonay, in Vivarais, by MM. Montgolfier, the inventors; a globe formed of canvas and paper, 105 feet in circumference, filled with inflammable air, reached an uncalculated height.

The same experiment has just been renewed at Paris (27th August, 5 P.M.) in presence of a great crowd. A globe of taffetas, covered by elastic gum, 36 feet in circumference, has risen from the Champ de Mars, and been lost to view in the clouds, being borne in a north-easterly direction; one cannot foresee where it will descend.

It is proposed to repeat these experiments on a larger scale. Any one who shall see in the sky such a globe (which resembles "la lune obscurcie"), should be aware that, far from being an alarming phenomenon, it is only a machine, made of taffetas, or light canvas covered with paper, that cannot possibly cause any harm, and which will some day prove serviceable to the wants of society.

Read and approved, 3rd September, 1783. DE SAUVIGNY.
Permission for printing. LENOIR.

Balloons made of paper and goldbeater's-skin were now sent up by amateurs from all places which this intelligence reached; and in September another important step was made, an account of which, and of the ascents which followed during the next two years, I take from the quaint but graphic 'History of Aerostation' by Tiberius Cavallo.

Tiberius Cavallo was an electrician and natural philosopher, born at Naples, 1749. He came to England in 1771, where he devoted his time to science and literature till his death, in 1809. In Old St. Pancras churchyard we may read the following inscription:—

Beneath are deposited the Remains
of TIBERIUS CAVALLO;
Son of a Neapolitan physician,
Who dedicated his life
To the attainment and improvement
of science,
Fixed his residence in this
country, as the chief seat of free inquiry,
Distinguished,
By many useful writings
and ingenious inventions,
In various branches of
Natural Philosophy,
and no less
The independence of his principles,
The gentleness of his manners,
and the innocence of his life.
Unenvied, beloved, and admired,
By a meritorious circle of friends,
Who justly appreciated in him,
Those solid,
But unostentatious qualities
That contribute, most essentially,
To the happiness of mankind.

## EXTRACT FROM CAVALLO'S HISTORY OF AEROSTATION.

*Montgolfier's Experiment at Versailles.*

On the 19th September, the King, Queen, the Court, and innumerable people of every rank and age, assembled at Versailles, Montgolfier being present to explain every particular. About one o'clock the fire was lighted, in consequence of which the machine began to swell, acquired a convex form, soon stretched itself on every side, and in eleven minutes' time, the cords being cut, it ascended, together with a wicker cage, which was fastened to it by a rope. In this cage they had put a sheep, a cock, and a duck, which were the first animals that ever ascended into the atmosphere with an aerostatic machine. When the machine went up, its power of ascension, or levity, was 696 pounds, allowing for the cage and animals.

The machine raised itself to the height of about 1440 feet; and being carried by the wind, it fell gradually in the wood of Vaucresson, at the distance of 10,200 feet from Versailles, after remaining in the atmosphere only eight minutes.

Two gamekeepers, who were accidentally in the wood, saw the machine fall very gently, so that it just bent the branches of the trees upon which it alighted. The long rope to which the cage was fastened, striking against the wood, was broken, and the cage came to the ground without hurting in the least the animals that were in it, so that the sheep was even found feeding. The cock, indeed, had its right wing somewhat hurt; but this was the consequence of a kick it had received from the sheep, at least half an hour before, in presence of at least ten witnesses.

*Aerostatic Experiments in which Men first ventured to ascend into the Atmosphere with an Aerostatic Machine.*—The preceding part of this history has shown the rapid progress of the subject, and has sufficiently demonstrated by experiments, that little or no danger is to be apprehended for a man who ascends with such a machine into the atmosphere. The steadiness of the aerostat whilst in the air, its gradual and gentle descent, the safety of the animals that were sent up with it in the last-mentioned experiment, and every other observation that could be deduced from all the experiments hitherto made in this new field of enquiry, seem more than sufficient to expel any fear for such an enterprise; but as no man had yet ventured in it, and as most of the attempts of flying, or of ascending into the atmosphere, on the most plausible schemes, had from time immemorial destroyed the reputation or the lives of the adventurers, we may easily imagine and forgive the hesitation that men might express, of going up with one of those machines: and history will probably record, to the remotest posterity, the name of M. Pilâtre de Rozier, who had the courage of first venturing to ascend into the atmosphere with a machine, which, a few years hence, the most timid woman will perhaps not hesitate to trust herself to.

The king, aware of the difficulties, ordered that two men under sentence of death should be sent up; but Pilâtre de Rozier was indignant, saying, "Eh quoi! de vils criminels auraient les premiers la gloire de s'élever dans les airs! Non, non, cela ne sera point." He stirs up the city in his behalf, and the king at length yields to the earnest entreaties of the Marquis d'Arlandes, who said that he would accompany him.

Scarce ten months had elapsed since M. Montgolfier made his first aerostatic experiment, when M. Pilâtre de Rozier publicly offered himself to be the first adventurer in the newly-invented aerial machine.

[Yet who but he undaunted could explore
A world of waves, a sea without a shore,
Trackless and vast and wild as that reveal'd,
When round the ark the birds of tempest wheel'd;
When all was still in the destroying hour,—
No sign of man! no vestige of his power!—ROGERS.]

His offer was accepted; his courage remained undaunted; and on the 15th of October, 1783, he actually ascended into the atmosphere, to the astonishment of a gazing multitude. The following are the particulars of this experiment.

The accident which happened to the aerostatic machine at Versailles, and its imperfect construction, induced M. Montgolfier to construct another machine, of a larger size and more solid. With this intent, sufficient time was allowed for the work to be properly done; and by the 10th of October the aerostat was completed, in a garden in the Fauxbourg St. Antoine. It had an oval shape, its diameter being about 48 feet, and its height about 74. The outside was elegantly painted and decorated with the signs of the zodiac, with cyphers of the king's name, fleurs-de-lys, &c. The aperture or lower part of the machine had a wicker gallery about three feet broad, with a balustrade both within and without, about three feet high. The inner diameter of this gallery, and of the aperture of the machine, the neck of which passed through it, was near 16 feet. In the middle of this aperture an iron grate, or brazier, was supported by chains, which came down from the sides of the machine. In this construction, when the machine was up in the air, with a fire lighted in the grate, it was easy for a person who stood in the gallery, and had fuel with him, to keep up the fire in the mouth of the machine, by throwing the fuel on the grate through port-holes made in the neck of the machine. By this means it was expected, as indeed it was found agreeable to experience, that the machine might have been kept up as long as the person in its gallery thought proper, or whilst he had fuel to supply the fire with. The weight of this aerostat was upwards of 1600 pounds.

On Wednesday, the 15th of October, this memorable experiment was performed. The fire being lighted, and the machine inflated, M. Pilâtre de Rozier placed himself in the gallery, and, after a few trials close to the ground, he desired to ascend to a great height; the machine was accordingly permitted to rise, and it ascended as high as the ropes, which were purposely placed to detain it, would allow, which was about 84 feet from the ground. There M. de Rozier kept the machine afloat during four minutes and twenty-five seconds, by throwing straw and wool into the grate to keep up the fire: then the machine descended exceedingly gently; and such was its tendency to ascend, that, after touching the ground, the moment M. de Rozier came out of the gallery, it rebounded up again to a considerable height. The intrepid adventurer, returning from the sky, assured his friends and the multitude, which had gazed on him with admiration, with wonder, and with fear, that he had not experienced the least inconvenience, either in going up, in remaining there, or in descending: no giddiness, no incommoding motion, no shock whatever. He received the compliments due to his courage and activity; having shown to the world the accomplishment of what had been for ages desired and attempted in vain.

On the 17th, M. Pilâtre de Rozier repeated the experiment with nearly the same success as he had two days before. The machine was elevated to about the same height, being still detained by ropes; but the wind being strong, it did not sustain itself so well, and consequently did not afford so fine a spectacle to the concourse of people, which at this time was much greater than at the preceding experiment.

On the Sunday following, which was the 19th, the weather proving favourable, M. Montgolfier employed his machine to make the following experiments.—At half after four o'clock, the machine was filled in five minutes' time; then M. Pilâtre de Rozier placed himself in the gallery, a counterpoise of 100 pounds being put in the opposite side of it, to preserve the balance. The size of the gallery had now been diminished. The machine was permitted to ascend to the height of about 210 feet, where it remained during six minutes, not having any fire in the grate; and then it descended very gently.

Soon after, everything remaining as before, except that now a fire was put into the grate, the machine was permitted to ascend to about 262 feet height, where it remained stationary during eight minutes and a half. On pulling it down, a gust of wind carried it over some large trees of an adjoining garden, where it would have been in great danger, had not M. de Rozier, with great presence of mind and address, increased the fire by throwing some straw upon it; by which means the machine was extricated from so dangerous a situation, and rose majestically, amongst the acclamations of the spectators, to the situation in which it stood before. On descending, M. de Rozier threw some straw upon the fire, which made the machine ascend once more, and then it descended to the ground.

This experiment showed that the aerostat may be made to ascend and descend at the pleasure of those who are in it; to effect which, they have nothing more to do than to increase or diminish the fire in the grate: which was an important point in the subject of aerostation.

After this, the machine was raised again with two persons in its gallery, M. Pilâtre de Rozier, and M. Girond de Villette; the latter of whom was therefore the second aerostatic adventurer. The machine ascended to the height of about 330 feet, where it remained perfectly steady for at least nine minutes; hovering over Paris, in

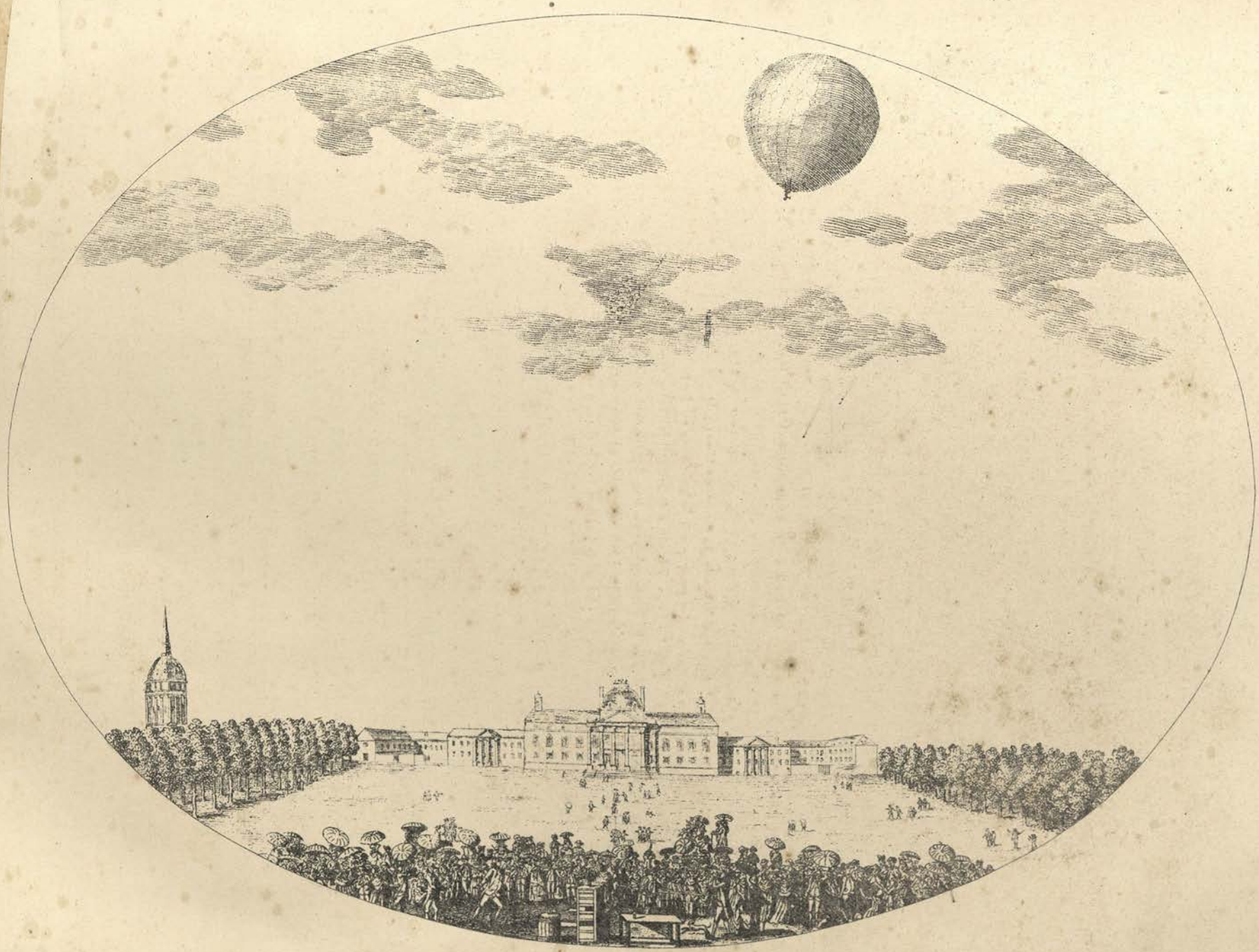


Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director.

sight of its numerous inhabitants, many of whom could plainly distinguish, through telescopes, the aerostatic adventurers, and especially M. de Rozier, who was busy in managing the fire.

The machine being come down, the Marquis d'Arlandes, major of infantry, took the place of M. Villette, and the aerostat was let up once more. This last experiment was attended with nearly the same success as the preceding: and they all proved and confirmed that the persons who ascended with the machine did not suffer the least inconvenience; which was owing to the gradual and gentle descent or ascent of the machine, and to its steadiness or equilibrium whilst it remained in the atmosphere.

If we consider for a moment the sensation which these first aerial adventurers must have felt in their exalted situation, we can hardly prevent an unusual sublime idea in ourselves. Imagine a man elevated to such an height, into an immense space, by means altogether new, viewing under his feet, like a map, a vast tract of country, with one of the greatest towns existing, the streets and environs of which were crowded with spectators, attentive to him alone, and all expressing, in every possible manner, their amazement and their anxiety. Reflect on the prospect, the encomiums, and the consequences; then see if your mind remains in a state of quiet indifference.

An instructive observation may be derived from those experiments, which is, that when an aerostatic machine is kept confined by ropes, especially at a considerable height above the ground, the wind blowing on it, must drive it in its own horizontal direction; so that the cords which hold the machine must make an angle with the horizon, which is greater when the wind is stronger, and contrarywise; in consequence of which the machine must be much fatigued; it being acted on by three forces, in three different directions; namely, its power of ascension, the confinement of the ropes, which is opposite to the first, and the action of the wind, which is across the other two. It is therefore infinitely more safe to abandon the machine entirely to the air, because then it stands perfectly balanced, and therefore is not at all fatigued.

In consequence of the report of the foregoing experiments, signed by the Commissaries of the Academy of Sciences, that learned and respectable body ordered, 1st, That the said report should be printed and published; and 2ndly, That the annual prize of 600 livres, according to the establishment of an anonymous citizen, be given to MM. Montgolfier, for the year 1783.

The account of a subsequent testimony to the importance of their discovery will not, I think, be here out of place, as in the year 1801 an obelisk was erected opposite the College of Annonay, on the spot from whence the first balloon rose, bearing this inscription :—

"Aux deux Frères Montgolfier—Leurs concitoyens reconnaissants."

This obelisk was voted in 1783, but was not inaugurated till 1801, by the prefect of Ardèche, who records it in these words :—

This day (16 prairial an IX. de la République française) we, Charles Ambroise Caffarelli, prefect of the department of Ardèche, finding ourselves whilst on circuit at Annonay accompanied by the citizen Larivoire La Tourette, sub-prefect of the first arrondissement.

The citizens of this "Commune" have expressed their desire to see erected the marble pyramid that citizens of Annonay had executed to commemorate the art of traversing the atmosphere, discovered by the two Montgolfiers, the first experiment having been made at Annonay, in presence of the former States of Vivarais, the 5th of June, 1783 (vieux style), a monument which was not finished till 1791, and which events have prevented erecting in the public place; the results already known from this astonishing discovery, which much contributed to the victory at Fleurus, and those that may still be expected, are of such importance, that the citizens of Annonay must long to see the monument erected as a witness to their love for the Arts, and their esteem for the Montgolfiers.

Touched by the sentiments that animate the inhabitants of Annonay, and considering the most honourable attribute of the rank to which we have been raised is that of encouraging the arts, and to render to the genius of discovery a striking testimony of the value the Government attaches to those who unite utility with fame—

We order that—The Pyramid shall forthwith be erected on the spot where the first experiment was made, on the 5th of June, 1783. The first stone of this obelisk shall be laid to-day, 16 prairial, corresponding to the 5th of June.

It was duly laid among the acclamations of thousands, who cried, "Vive la République!

The experiments hitherto made, especially those of the 19th of October, having prepared the way for a fair aerial navigation, the attempt was fixed for the 20th of November, 1783, everything being prepared for it at La Muette, a royal palace in the Bois de Boulogne. Notwithstanding that no advertisement relative to the experiment had been mentioned in the public papers, a vast multitude assembled in the garden at La Muette on the morning of the above-mentioned day. The necessary operations were begun; but the rain and the wind, which came on suddenly, obliged M. Montgolfier to defer the performance of the experiment to the following day, provided the weather proved more favourable.

Accordingly, on the 21st, the wind, which blew at intervals, and the appearance of large clouds, threatened a second disappointment; notwithstanding which, everything being got in readiness, the machine was filled in a few minutes' time, and M. de Rozier, together with the Marquis d'Arlandes, placed themselves in the gallery one on one side of it, and the other on the opposite, in order to preserve the equilibrium. But as M. Montgolfier intended to make some preliminary experiments relative to the power of ascension of the machine, &c., the aerostat was kept confined by ropes, in consequence of which the wind agitated it violently, and at last forced it to the ground, which damaged and tore it in several places; and it would have been entirely burned had not timely assistance prevented it. Notwithstanding this disagreeable accident, by an extraordinary exertion of the workmen the aerostat was replaced on the scaffold, and was repaired in less than two hours. They then filled it again, put into the gallery the necessary fuel, and the two intended travellers entered the gallery with courage and eagerness. The whole weight of the machine, travellers and all, was between 1600 and 1700 pounds.

The aerostat left the ground at fifty-four minutes past one o'clock, passed safely over some high trees, and ascended calmly and majestically into the atmosphere. The aeronauts having reached the altitude of about 280 feet, took off their hats and saluted the surprised multitude. They then rose too high to be distinguished, so that the machine itself was scarce perceivable. When they rose, the wind was very nearly north-west, and it is said that the machine, in rising, made half a turn round its own axis. The wind drove them horizontally over the River Seine, and over Paris. They passed between the *Hôtel des Invalides* and the *École Militaire* and approached *Saint-Sulpice;* but, as they were rather low, the fire was increased in order to clear the houses, and in rising higher they met with a current of air which carried them southward. They passed the *Boulevard;* and at last, seeing that the object of the experiment was fully answered, the fire was no longer supplied with fuel, and the machine descended very gently in a field beyond the new *Boulevard*, about 9000 yards distant from the palace of *La Muette*, which distance they ran in between twenty and twenty-five minutes' time. The Marquis d'Arlandes stepped out of the gallery the moment it touched the ground; but the machine collapsing immediately after, M. de Rozier, who stood on the side opposite to the wind, was covered by the canvas, from which dangerous situation, however, he soon extricated himself. Otherwise they had suffered no inconvenience whatever.

When they came down, about two-thirds of the fuel was still remaining in the gallery; so that they might have kept themselves up a much longer time. The machine was soon folded up, and, being put on a cart, was sent to the place where it had been originally constructed, in the Fauxbourg St. Antoine.

Thus far has been collected from the accounts given by various spectators, and especially from the affidavit of the experiment, which was signed by the Dukes of Polignac and de Guines, Counts de Polastron and de Vaudreuil, Dr. Benjamin Franklin, and MM. Faujas de Saint-Fond, Delisle, and Leroy, of the Academy of Sciences. But, as the transactions of the aeronauts during their voyage can only be learned from themselves, and as those circumstances seem to be peculiarly useful and instructive, I shall subjoin the translation of part of a letter, written by the Marquis d'Arlandes to M. Faujas de Saint-Fond, on this subject.

"At this time M. Pilâtre said, *You do nothing, and we shall not mount.* Pardon me, I replied.—I threw a truss of straw upon the fire, stirring it a little at the same time, and then quickly turned my face back again; but I could no longer see *La Muette.* Astonished, I gave a look to the direction of the river. . . . M. Pilatre then said, *See, there is the river, and observe that we descend.* Well, then, my friend, *let us increase the fire;* and we worked away. But instead of crossing the river, as our direction seemed to indicate, which carried us over the house of the *Invalides*, we passed along the island of Cygnes, re-entered over the principal bed of the river, and advanced up it as far as the gate *de la Conference.* I said to my intrepid companion, *See, there is the river*, &c. I stirred the fire, and took with the fork a truss of straw, which, from being too tight, did not take fire very easily. I lifted and shook it in the middle of the flame. The next moment I felt as if I were lifted up from under the arms, and said to my companion, *Now we mount*, &c. At the same time I heard a noise towards the top of the machine, as if it were going

to burst; I looked, but did not see anything. However, as I was looking up, I felt a shock, which was the only one I experienced. The direction of the motion was from the upper part downwards. I said then, *What are you doing? Are you dancing?—I don't stir*, said he. *So much the better*, replied I, *it is then a new current, which, I hope, will push us over the river.* In fact, I turned myself in order to see where we were, and I found myself between *l'Ecole Militaire* and *les Invalides*, beyond which place we had already gone about 2500 feet. M. Pilâtre said, at the same time, *We are on the plain. Yes*, said I, *and we advance. Work on*, said he. I then heard another noise in the machine, which appeared to be the effect of a rope breaking. This fresh admonition made me examine attentively the interior of our habitation. I saw that the part of the machine, which was turned towards the south, was full of round holes, many of which were of a considerable size. I then said, *We must descend*, and at the same time I took the sponge and easily extinguished the fire, which was round some holes that I could reach; but leaning on the lower part of the linen, to observe whether it adhered firmly to the surrounding circle, I found that the linen was easily separated from it, on which I repeated, that it was necessary to descend. My companion said, *We are over Paris. Never mind that*, said I, *but look if there appears any danger for you on your side—are you safe?* He said *Yes.* I examined my side, and found that there was no danger to be apprehended. Farther, I wetted with the sponge those cords which were within my reach. They all resisted, except two, which gave way. I then said, *We may pass over Paris.* In doing this, we approached the tops of the houses very sensibly; we increased the fire, and rose with the greatest ease. I looked below me, and perfectly discovered the *Mission Etranger.* It seemed as if we were going towards *Saint-Sulpice*, which I could perceive through the aperture of our machine. On rising, a current of air made us leave this direction, and carried us towards the south. I saw on my left a sort of forest, which I took to be the Luxembourg; we passed over the Boulevard, and I then said, *Let us now descend.* The fire was nearly extinguished; but the intrepid M. Pilâtre, who never loses his presence of mind, and who went forward, imagining that we were going against the mills that are between *Petite Gentilly* and the *Boulevard*, admonished me. I threw a bundle of straw on the fire, and shaking it in order to inflame it more easily, we rose, and a new current carried us a little towards our left. M. Rozier said again, *Take care of the mills:* but as I was looking through the aperture of the machine, I could observe more accurately that we could not meet with them, and said, *We are there.* The moment after, I observed that we went over a piece of water, which I took for the river, but after landing, I recollected that it was the piece of water, &c. The moment we touched the ground, I raised myself up in the gallery, and perceived the upper part of the machine to press very gently on my head, I pushed it back, and jumped out of the gallery, and on turning myself towards the machine, expected to find it distended, but was surprised to find it perfectly emptied, and quite flattened," &c.

*Account of the first Aerostatic Experiment made in England.*—It is somewhat remarkable, that more than five months had elapsed, since M. Montgolfier made his first public aerostatic experiment at Annonay, the news of which, as well as of his subsequent experiments, was rapidly and universally spread, and yet no experiment of the kind had been made out of France, at least none is authentically recorded. In this island, where the improvements of arts and sciences find their nursery, and many their birth, no aerostatic machine was seen before the month of November, 1783. It was, perhaps, owing to a persuasion that this new field of experiment was in the hands of persons fully capable to improve it in France; and consequently that it would be useless to lose time, trouble, and expense, about experiments, which others were actually making elsewhere. At least, the curiosity of the learned might have been satisfied with an experiment in small; but it often happens in a nation, that a sort of stupor prevents even the most necessary and easy exertions, in particular cases, for which omission, a short time after, no person can assign any plausible reason. However, it must be confessed, that the news of the first aerostatic experiments was far from giving any exact account of the practical part, or of the principles themselves.

Let this be as it may, the matter of fact is, that the first aerostatic experiment was shown in London in the month of November, 1783. Count Zambeccari, an ingenious Italian, who happened to be in London, made a balloon of oil-silk, which was ten feet in diameter, and weighed eleven pounds. It was gilt, both in order to render it more beautiful, and more impermeable to the inflammable air (hydrogen). This balloon was publicly shown for several days in London; and at last, on the 25th of the above-mentioned month, three-quarters of it were filled with inflammable air; a direction, for any person who should afterwards find it, inclosed in a tin-box, was fastened to it, and, in the presence of many thousand spectators, it was launched from the Artillery Ground, at one o'clock in the afternoon.

Two hours and a half after, viz., at half-past three o'clock, this balloon was found at Graffam, near Petworth, in Sussex, forty-eight miles distant from London; so that it went at the rate of near twenty miles an hour. A rent found in it, which was certainly the consequence of the rarefaction of the inflammable air, when the balloon came into a much lighter part of the atmosphere, must have been the occasion of its descent.

We must now return to the aerostatic experiments made in France, and must defer describing those made in England till the order of time renders it necessary.

*Account of the first Aerial Voyage made with an inflammable-air (hydrogen) Balloon.*—The success of the experiment with the inflammable-air balloon, made in the *Champ de Mars*, and the other experiments made after that, with M. Montgolfier's aerostat, naturally suggested the idea of attempting a voyage in an inflammable-air balloon; every consideration, excepting the dearness of the inflammable air, seeming to give the preference to the inflammable-air balloon, as a vehicle for an aerial voyage.

The plan for such a voyage, and every necessary calculation, being made, the balloon was constructed by the Roberts, two brothers, very intelligent in mechanics. Their project was first announced to the public in the 'Journal de Paris' of the 19th of November, 1783; and a subscription was opened in order to defray the expenses, which, as it was calculated, would amount to about ten thousand livres.

As soon as the balloon was finished it was inflated with common air, and was publicly shown in one of the great chambers of the Tuileries till the 26th, on which day it was suspended to a rope stretched between two trees before the Tuileries.

This balloon was made of gores of silk, covered with a varnish, said to be a solution of elastic gum (*caoutchouc*). Its form was spherical, measuring twenty-seven feet and a half in diameter. A net went over the upper hemisphere, and was fastened to a hoop that went round the middle of the balloon, and was therefore called its equator. To this equator was suspended, by means of ropes, a sort of car, or rather a boat, which swung a few feet below the balloon. In order to prevent the bursting of the machine, by the expansion of the inflammable air, a valve was made in it, which, by pulling a string, was opened to let out some of the inflammable air. There was likewise a long silken pipe, through which the balloon was filled. The boat, made of basket-work, was covered with painted linen, and was beautifully ornamented. Its length was near eight feet, its breadth four, and its depth three and a half. It weighed 130 pounds.

This famous experiment was performed on Monday, the 1st of December, 1783. The Tuileries, the *Pont Royal*, every house, and every adjacent place, were crowded with spectators. A numerous guard of soldiers preserved order, and protected the operation. Mathematical persons, with proper instruments, were conveniently stationed for the purpose of calculating the height, rate of going, and other particulars concerning the balloon. Signals were given by the firing of a cannon, waving of pendants, &c. A small balloon of six feet in diameter was launched by M. Montgolfier, which served to show the direction of the wind, and likewise to amuse the people. The boat was then attached to the balloon; M. Charles and one of the Roberts seated themselves in it, with proper instruments, plenty of provisions, clothing, and the ballast, consisting of sand-bags; and at three-quarters after one o'clock the machine left the ground, and ascended with a moderately accelerated course. The astonished spectators stood silent.

It may be said of this ascent that Charles completely created the "*appareil*" of aerostation; for in reality he thought of the valve for allowing the escape of gas to cause a slow and gradual descent of the aerostat, the car for the voyagers to sit in, the number of ropes to support it, the ballast to regulate, and the barometer to measure ascent and descent; and also the varnish that renders the silk impermeable, and prevents the loss of gas. For this, his first ascent, Charles created all these ingenious contrivances; since then nothing has been changed, little has been added. He gave his name to the Charlières, or gas balloons.

When the balloon had reached the altitude of about six hundred yards, the two aerial navigators indicated their safety by frequently waving two pendants, though they themselves could not be distinguished from the

ground. The spectators were by this time awakened from their astonishment; enthusiasm took the place of silence, and nothing but expressions of praise and applause were by every mouth annexed to the names of Charles and Robert.

Soon after their ascent, they remained stationary for a short time; then they went horizontally in the direction N.N.W. They crossed the Seine, and passed over several towns and villages, to the great astonishment of the inhabitants, who did not expect, and perhaps had never heard of, this new sort of experiments. This delicious voyage lasted one hour and three-quarters. At last they descended in a field near *Nesle*, a small town, about twenty-seven miles distant from Paris, it being then three-quarters past three o'clock; so that they had gone at the rate of about fifteen miles per hour, without feeling the least inconvenience; and the balloon underwent no other alteration, than what was occasioned by the dilatation and contraction of the inflammable air, according to the vicissitudes of heat and cold.

A short time after their descent, they were overtaken by the Dukes de Chartres and de Fitz-James, who had rode after the balloon, and did them the honour to add their names to the certificate of their descent, which had been already drawn up and signed by other persons, who had arrived sooner.

The balloon still containing a considerable quantity of inflammable air, M. Charles determined to ascend once more. M. Robert then got out of the boat, which lightened the balloon of 130 pounds. This weight they intended to supply with ballast; but not finding any conveniency to take up any earth or stones very readily, and the sun being near setting, M. Charles, without losing more time, gave the signal to the peasants who held down the machine, to let go; "And I sprung up," says he, "like a bird. In twenty minutes I was 1500 toises high; out of sight of all terrestrial objects. I had taken the necessary precautions against the explosion of the globe, and prepared to make the observations which I had promised myself. In order to observe the barometer and thermometer, placed at the end of the car, without altering the centre of gravity, I knelt down in the middle, stretching forward my body and one leg, holding my watch and paper in my left hand, and my pen and the string of the valve in my right, waiting for the event. The globe, which, at my setting out, was rather flaccid, swelled insensibly. The air escaped in great quantities at the silken tube. I drew the valve from time to time, to give it two vents; and I continued to ascend, still losing air, which issued out hissing, and became visible, like a warm vapour in a cold atmosphere. The reason of this phenomenon is obvious. On earth, the thermometer was 47°, or 15° above freezing point; after ten minutes' ascent it was only 21°, or 11° below. The inflammable air had not had time to recover the equilibrium of its temperature. Its elastic equilibrium being quicker than that of the heat, there must escape a greater quantity than that, which the external dilatation of the air could determine by its least pressure. For myself, though exposed to the open air, I passed in ten minutes from the warmth of spring to the cold of winter: a sharp dry cold, but not too much to be borne. I declare that, in the first moment, I felt nothing disagreeable in the sudden change. When the barometer ceased to fall, I marked exactly 18 inches 10 lines (20·01 in. English), the mercury suffering no sensible oscillation. From this I deduce a height of 1524 toises (3100 yards), or thereabouts, till I can be more exact in my calculation. In a few minutes more, my fingers were benumbed by the cold, so that I could not hold my pen. I was now stationary as to the rising and falling, and moved only in an horizontal direction. I rose up in the middle of the car to contemplate the scene around me. At my setting out the sun was set on the valleys; he soon rose for me alone, who was the only luminous body in the horizon, and all the rest of nature in shade; he, however, presently disappeared, and I had the pleasure of seeing him set twice in the same day. I beheld, for a few seconds, the circumambient air and the vapours rising from the valleys and rivers. The clouds seemed to rise from the earth and collect one upon the other, still preserving their usual form, only their colour was grey and monotonous from the want of light in the atmosphere. The moon alone enlightened them, and showed me that I was tacking about twice; and I observed certain currents that brought me back again. I had several sensible deviations; and observed, with surprise, the effects of the wind, and saw the streamers of my banners point upwards This phenomenon was not the effect of the ascent or descent, for I then moved horizontally. At that instant I conceived, perhaps a little too hastily, the idea of being able to steer one's course. In the midst of my transport I felt a violent pain in my right ear and jaw, which I ascribed to the dilatation of the air in the cellular construction of those organs, as much as to the cold of the external air. I was in a waistcoat and bareheaded. I immediately put on a woollen cap, yet the pain did not go off but as I gradually descended. For seven or eight minutes I had ceased to ascend; the condensation of the internal inflammable air rather made

me descend. I now recollected my promise to return in half an hour, and, pulling the string of the valve, I came down. The globe was now so much emptied, that it appeared only an half globe. I perceived a fine ploughed field near the wood of *Tour du Lay*, and hastened my descent. When I was between twenty and thirty toises from the earth I threw out hastily two or three pounds of ballast, and became for a moment stationary, till I descended gently in the field, above a league from the place whence I set out. The frequent deviations and turnings about make me imagine that this voyage was near three leagues, and I was gone about thirty-three minutes. Such is the certainty of the combinations of our aerostatic machine, that I might have kept in the air at least for twenty-four hours longer."

For this exploit he received from the king a pension of 200*l*., who also ordered his name to be inscribed on the Montgolfier medal; but it was a case in which we* may repeat the saying of the great Condé:—"Il eut du courage ce jour-là," as he never ascended again, having sworn, it is said, not to do so when Robert left the car; and he ascended alone with the swiftness of an arrow.

We will pass over many accounts of minor interest, and insert one which could not reach our narrator in those steamless days. Experiments had been made at Philadelphia, U.S., as to the adoption of gas for balloons, almost simultaneously with its adoption in France; a remarkable coincidence, frequently noticed in the history of discovery and invention. For, on the arrival of the news of P. de Rozier and Marquis d'Arlandes exploit, Messrs. Rittenhouse and Hopkins, members of the Philosophical Academy of that city, instituted a series of experiments, which resulted in the construction of a machine with forty-seven small hydrogen balloons attached to a car, or cage (as they called it). After some preliminary trials of animals, and one man let up to a certain height, and pulled down by ropes, Mr. James Wilcox, a carpenter, ascended free (28th December, 1783). Perceiving himself rapidly approaching the Schuykell River, and apprehensive of falling into it, he took the necessary steps to occasion his descent, and, according to his instructions, made incisions in three balloons; but this proving ineffective, he cut three more, and then five, nearly all at the same time. This caused so violent a descent that he dislocated his wrist. Such was the first experiment in the New World.

On the 7th of January, 1784, the pieces which were to form the largest aerostatic machine hitherto launched were brought out of Lyons into one of the suburbs, called Les Brotteaux, and the two following days were employed to join those pieces together. In the morning of the 10th they made the first essay. The fire was lighted, and in twenty minutes the machine was perfectly inflated, and in this state the cords which were to hold the gallery were begun to be fixed. On the 12th they inflated the machine again in order to fix more of the ropes for the gallery; and, in short, they worked incessantly till the 19th to fix the ropes, to attempt the aerial voyage, and to repair the rents and other damages which the machine continually received from being often inflated and from the injuries of the weather; for the rain, the snow, the frost, and almost all the elements, seemed angry with this unfortunate machine, which, being constructed of bad materials, was little able to sustain those injuries. Nevertheless, in various trials it had shown its surprising power; and once, on putting a bundle of straw, upon which spirit of wine had been sprinkled, on the fire, the sudden flame occasioned such a rarefaction, that the machine, notwithstanding the efforts of fifty persons who were employed to hold it, rose three feet from the ground, and went to the distance of fifteen feet.

At last, on the 19th, the weather was pretty clear with very little wind, the sun showing itself at intervals. The thermometer stood at 45°. Everything was got ready for the experiment, and a prodigious crowd of spectators

* 'Revue des Deux Mondes,' 1852.

assembled about the place; but as the machine had been wet, and in the night it had frozen very hard, it was necessary to thaw the ice by degrees, which was effected by making several small fires under the scaffold; but this naturally took up a considerable time, so that the experiment could not be begun before noon. The fire was now lighted, and the machine soon began to swell, assuming the best form that could be wished; but the spectators, who had been often disappointed, showed at this time a great deal of anxiety, their minds seeming to fluctuate between hope and fear. In seventeen minutes the machine was filled, and was ready to ascend; the intended six passengers took their places in the gallery, and nothing was wanting but the signal of departure from M. de Rozier. But this gentleman, considering the indifferent condition of the machine, that had greatly suffered in the preceding trials, was of opinion that the experiment would certainly fail if more than three persons ascended with it: his remonstrances were of no effect, for none of the adventurers would leave his place on any account whatever. Upon this, the interposition of M. le Flesselles, the intendant, was requested; but his authority could not prevail on them to cast lots. At last, their obstinacy being unconquerable, the signal of departure was given, with reluctance and with fear, and the ropes were cut off. A very remarkable instance of enthusiasm, rather than courage, happened at this instant. The machine was not raised above a foot or two from the ground, when a seventh person, one M. Fontaine, jumped into the gallery, which occasioned a sudden depression of the machine; but, by increasing the fire in the grate, the whole ascended majestically and with moderate rapidity. On meeting with the wind, it was turned from the east, instantly, towards the west; but it afterwards proceeded east-south-east, ascending at the same time till it was at least a thousand yards high. The effect produced on the spectators by this spectacle is described as the most extraordinary that was ever occasioned by any production of human invention. It was a mixture of the strangest nature. Vociferations of joy, shrieks of fear, expressions of applause, the sound of martial instruments, and the discharge of mortars, produced an effect more easily imagined than described. Some of the people fell on their knees, and others elevated their suppliant hands to the heavens; some women fainted, and many wept: but the confident travellers, without showing the least appearance of fear, were continually waving their hats out of the gallery. The wind shifted again, but it was very feeble, so that the machine stood almost stationary for about four minutes.

Unfortunately, about this time, which was near fifteen minutes after the ascent, a rent was made in the machine, which occasioned its descent; and when it came within about six hundred feet of the ground it descended with a very great celerity. It is said that not less than sixty thousand people, besides the Marechaussée, ran to the spot, with the greatest apprehension for the lives of those adventurous aerial travellers. They were immediately helped out of the gallery, and luckily none of them had received any hurt, except M. Montgolfier an insignificant scratch. The machine was torn in several places, besides a vertical rent of upwards of fifty feet in length; which shows very clearly how little danger is to be apprehended from the use of those machines, especially when they are properly constructed and judiciously managed.

The following are the names of the seven travellers: M. Joseph Montgolfier, M. Pilâtre de Rozier, Count de Laurencin, Count de Dampierre, Prince Charles de Ligne, Count de Laport d'Anglefort, and M. Fontaine.

*Aerostatic Experiments made in February and March*, 1784.—The first balloon that crossed the English Channel was launched from Sandwich in Kent, on Friday, the 22nd of February, 1784. It was an inflammable-air balloon, five feet in diameter, which was let loose at half-past twelve o'clock, in the presence of a great many spectators. The balloon rose rapidly, and was carried over the sea by the wind, which was west by north; so that the direction of the balloon was east by south. It was found, at three o'clock of the same day, in a field near Warneton, in French Flanders, nine miles from Lisle, by a boy, who carried it to Monsieur Betrayle, at Warneton; and, there being a ticket on the balloon, in which it was requested that an account of the time when, and place where, the said balloon should be found, might be sent to William Boys, Esq., at Sandwich, such request was politely complied with. The straight distance between Sandwich and Warneton is seventy-four miles and a half, so that this balloon went at the rate of above thirty miles an hour.

The Chevalier Paul Andreani, of Milan, was the first person in Italy who had an aerostatic machine made at his own expense for the purpose of making an aerial voyage, in which attempt he actually succeeded on the 25th of February, 1784. The project was entirely his own, but for the practical execution of the work he employed the brothers Augustin and Charles Gerli, persons of a mechanical genius.

The machine was spherical, of about sixty-eight feet in diameter, made of linen, lined with fine paper. In

the inside, towards the middle of the machine, there was a wooden zone or hoop; and another hoop, of fourteen feet in diameter, was round its aperture. On the top of the machine there was a sort of hat, or round piece of wood, strengthened with an iron hoop, from which ropes proceeded, which went down along the seams of the machine, and were lastly fastened to the hoop of the aperture. Other smaller cords were fastened to the linen, and, crossing the larger ropes, made a sort of network. Some short wooden arms, which proceeded from the hoop of the aperture, held the fireplace or copper brazier, of about six feet and a half in diameter. Cords proceeding from the same hoop held a circular basket, which stood under the brazier at a moderate distance from it, so that the persons in it might easily supply the fire with fuel and at the same time were not incommoded by the heat.

The machine, being constructed, was secretly transported to a seat of the Chevalier, called Moncucco, which is eight miles distant from the town. Two ineffectual trials were made: each time the machine was perfectly inflated in fifteen minutes, but it did not lift up the annexed weight from the ground. However, on the 25th, at about noon, the fire under the machine was lighted; it was supplied at first with very dry wood, and afterwards with a composition of bituminous substances. The machine now made evident endeavours to rise, and, it being imagined that giving more freedom to the air under it would increase its power, the Chevalier judiciously ordered those who held the ropes to let the machine rise a little, which was attended with the desired effect. The machine instantly manifested it had acquired an increase of power, in consequence of which the Chevalier and the two brothers Gerli put themselves into the gallery or circular basket; the ropes were let loose, and the machine, with the three adventurers, immediately ascended, with a slow and almost horizontal motion, directing itself towards the building, to avoid which the fire was increased, and then the machine ascended with rapidity to a great height, so that it was seen from the city, which was eight miles off. At this height they met with a current of air which seemed to drive the machine towards the adjoining mountains; but as this was not an eligible direction, and as the fuel was almost exhausted, they thought proper to descend; and accordingly, the fire being diminished, the machine gradually descended. In coming down the aerostat was going directly over a large tree, but by a proper management of the fire it just cleared the tree; after which the people that had run to its assistance laid hold of the ropes that were swinging down and conducted the machine to a safe place, where the intrepid travellers alighted without the least inconvenience. In consequence of the loss of this weight the machine acquired such power that it required the assistance of many persons to detain it. The machine being thus capable of keeping itself swelled, they availed themselves of its condition, and carried it, in that inflated state, over trees and other obstructions, to the place where it had been filled, which was not above a quarter of a mile distant. The machine remained in the atmosphere for about twenty minutes. It is remarkable that this machine, notwithstanding the various trials it had undergone, had not suffered the least damage. Its upper part especially, like that of the machine used in the experiment at Versailles and that also at La Muette, was neither scorched nor in any other manner affected by the fire, which is a circumstance deserving of notice, particularly because it has been commonly said that the upper part of those machines would be always burned or scorched.

On the 19th of February an inflammable-air balloon of five feet in diameter was launched from Queen's College, at Oxford. It was of a spherical form, made of varnished Persian silk, and it seems that this was the first balloon seen in that town.

The next aerial voyage we are to describe was made by one who, as will appear from the sequel of this history, has performed a greater number of these excursions than any other person previous to February, 1785, and is the first who crossed the English Channel with an aerostatic machine. This ingenious Frenchman, M. Jean-Pierre Blanchard, had, for several years before M. Montgolfier's discovery, busied himself in attempts to fly by mechanical means; but it appears, from a passage in a letter of his to the editors of the 'Journal de Paris,' that he never succeeded in this undertaking:* but, as soon as the discovery of the aerostatic machine was made, he immediately resolved to use one of those machines for the lifting power, and to add the wings of his former scheme for directing his course through the air.

After a great deal of contrivance, and some calculation, M. Blanchard at last constructed an inflammable-air balloon of twenty-seven feet in diameter, with a boat made and suspended nearly in the same manner as that of Charles and Robert, only he added two wings and a rudder (*gouvernail*) to his boat. He had likewise a sort of large

* "Je rends donc un hommage pur et sincère à l'immortel Montgolfier, sans le secours duquel j'avoue que le mécanisme de mes aîles ne m'auroit peut-être jamais servi qu'à agiter un élément indocile qui m'auroit obstinément repoussé vers la terre comme le lourd autruche, moi qui comptois disputer à l'aigle le chemin des nues."

umbrella spread horizontally between the balloon and the boat, which, in case the balloon should burst, would check the fall.

With this balloon M. Blanchard made his first aerial voyage on the 2nd of March, 1784. As the incidents of this voyage are of a very strange and romantic nature, I think that a particular account of them will not be unacceptable to the reader. The balloon, with the rest of the machinery and apparatus for filling it, was carried to the Champ de Mars, the place from whence the first inflammable-air balloon had been launched; and, as usual on similar occasions, an immense number of people assembled about the place. The machine being filled, M. Blanchard and a Benedictine Friar seated themselves in the boat; the ropes were cut off, and they ascended, but not higher than about fifteen feet from the ground. Then the balloon being leaky, and the weight in the boat rather too great, the whole fell very rapidly, and on touching the ground the boat received an unpleasant shock, in consequence of which the Friar was persuaded to abandon his seat. But the intrepid M. Blanchard was not at all intimidated by the accident; he immediately repaired the little damage the apparatus had received from the fall, and was going to ascend again by himself; but, just as he was setting off, a young gentleman forced his way through the crowd, jumped into the boat, and, without any right or reason, insisted upon going up with M. Blanchard.

This youth (from the Military Academy) was for some time believed to be Napoleon Buonaparte; but, on a more careful inquiry, his name was found to be Dupont de Chambon. Napoleon also contradicted this in conversation with Las Cases at St. Helena.

Every expostulation or remonstrance of M. Blanchard, and of many persons of the first rank who were present, was ineffectual to persuade the young gentleman to give up this desperate attempt. His answer was, that he was provided with the King's licence; and, on being desired to show it, he presented his sword, with which, it is said, he wounded M. Blanchard on the wrist. At last, the Marquis de Conflans, at the risk of his life, pulled the young enthusiast out of the boat, and, delivering him to the guards, ordered them to confine him. This strange contest being over, M. Blanchard alone, without fear or hesitation, ascended with his balloon very rapidly into the atmosphere; but, notwithstanding his endeavours, the wings and rudder of the boat seemed to have no effect, and the wind drove the balloon in its direction. It crossed the river, and went over Passy; but M. Blanchard found a perfect calm, so that it remained stationary for about fourteen minutes. Then he crossed the river a second time, and in this passage the clouds appeared under his feet. He now felt the heat of the sun's rays, which was rather strong, and stood stationary again for about fifteen minutes, the balloon being at the same time agitated by two opposite currents of air, on which he threw four pounds of ballast out of the boat, and, ascending higher, met with that current of air in which he had gone at first, and which carried him very rapidly again across the river. Here he was obliged to throw out more ballast, by which means the voyage was prolonged as far as the plain of Billancourt, near Sèvres, where he descended at thirty-five minutes past one o'clock, after having been in the atmosphere an hour and a quarter, during which time he had experienced heat, cold, hunger, and an excessive drowsiness. On his return to earth he was welcomed by many thousands of people, who had watched his progress all the way.

On the 13th of March the Chevalier Andreani, and two other persons, ascended a second time into the atmosphere with a rarefied-air machine, from the same place where he had performed his first experiment. The machine attained to the height of 5200 feet, and travelled to the distance of seven miles.

It was about this time that M. Argand, an ingenious gentleman of Geneva, being in England, had the honour of exhibiting the aerostatic experiment, with an inflammable-air balloon of about thirty inches in diameter, in the presence of the King, Queen, and royal family at Windsor.

After the month of February balloons of both kinds, but especially filled with rarefied air, became very common in England as well as in other parts of Europe. In London, during the spring, the summer, and the autumn, paper balloons, raised by means of spirit of wine, and generally from three to five feet in diameter, were seen flying by night as well as by day. All ranks of people seem to have found pleasure in such kind of experiments; and so much had the subject engaged general attention, that, both in earnest and in jest, the epithet of *balloon* was annexed to articles of dress, of house-furniture, of instruments, &c. Thus, one commonly heard of balloon hats, balloon colours, balloon coaches, and such like empty phrases.

*Aerostatic Experiments made in the Months of May, June, and July*, 1784.—At Paris, on the 20th of May, M. Montgolfier made a private experiment with an aerostatic machine of seventy-four feet in height and seventy-two in diameter, with which four ladies ascended in the atmosphere. This machine was raised from the Faubourg Saint Antoine, and was elevated above the highest buildings of Paris, where it remained confined by ropes for a considerable time. Those courageous ladies were—

Mmes. La Marquise de MONTALEMBERT;
La Comtesse de MONTALEMBERT;
La Comtesse de PODENAS;
Mlle. De LAGARDE; accompagnées de
MM. Le Marquis de MONTALEMBERT et
Artaud de BELLEVUE.

Towards the latter end of May the following remarkable accident happened at Dijon; it is related by the ingenious M. de Morveau. A balloon, intended to be filled with inflammable air, being completed, was, by way of trial, filled with common air, and in this state was kept in the open air. Now it was observed, and indeed a similar observation had been made before, that the air within the balloon was much hotter than the circumambient air: the thermometer in the former stood at 120°, whereas in the latter, and when the sun shone upon it, the thermometer stood at 84°. This showed a considerable degree of rarefaction within the balloon, and, consequently, it was suspected that by means of this rarefaction alone—especially if it were to increase a little—the balloon might ascend. On the 30th, about noon, the wind, being rather strong, agitated the balloon so that two men were employed to take care of it; but, notwithstanding their endeavours, the balloon escaped from its confinement, and lifting up about sixty-five pounds weight of cords, equatorial circle, &c., rose several feet high, and, passing over several houses, went to the distance of about two hundred and fifty yards, where it was at length properly secured.

At Lyons, on the 4th of June, in the presence of the King of Sweden, two persons, namely, M. Fleurand and Madame Thible, ascended with an aerostatic machine called Le Gustave, which was seventy feet in diameter. They went to the distance of about two miles in forty-five minutes. The greatest altitude reached in this excursion is estimated at about 8500 feet. This experiment will probably be long remembered, since it was the first time that a woman made an aerial voyage.

On the 23rd of June a large aerostat, on the principle of rarefied air, was elevated at Versailles, in the presence of the royal family and the King of Sweden, who travelled under the name of Count Haga. The height of this machine was ninety-one feet and a half, and its diameter seventy-nine. M. Pilâtre de Rozier and M. Prouts ascended with it. The machine was filled in thirty-five minutes, and it left the ground at forty-five minutes after four o'clock. In three-quarters of an hour it went to the distance of thirty-six miles, when it safely descended in a field, which, having no name, was, by order of the Prince de Condé, called Pilâtre de Rozier, in honour of that celebrated first aerial traveller, who had likewise gone with this machine, and to whom, after this experiment, the King was pleased to grant a pension of two thousand livres.

On the 15th of July the Duke de Chartres, the two brothers Robert, and another person, ascended with an inflammable-air balloon from the Park of St. Cloud at fifty-two minutes past seven o'clock in the afternoon. This balloon was of an oblong form, measuring fifty-five feet and a half in length and thirty-four in diameter. It ascended with its greatest extension nearly horizontal; and, after remaining in the atmosphere about forty-five minutes, it descended at a little distance from whence it had ascended, and at about thirty feet distance from the Lake de la Garenne, in the Park of Meudon. But the incidents that happened in this aerial excursion deserve to be particularly described, as nothing like it had happened before to any of the aerial travellers. This machine contained an interior smaller balloon, filled with common air; by which means, according to a scheme hereafter to be mentioned, the machine was to be made to ascend or descend without any loss of inflammable air or ballast. The boat was furnished with a helm and oars, intended to guide it, &c.

On the level of the sea the barometer stood at 30·25 inches; and at the place of departure it stood at 30·12. Three minutes after its ascending the balloon was lost in the clouds, and the aerial voyagers lost sight of the earth, being involved in a dense vapour. Here an unusual agitation of the air, somewhat like a whirlwind, in a moment turned the machine three times from the right to the left. The violent shocks which they suffered prevented their using any of the means prepared for the direction of the balloon; and they even tore away the silk stuff of which the

helm was made. Never, said they, a more dreadful scene presented itself to any eye than that in which they were involved. An unbounded ocean of shapeless clouds rolled one upon another beneath, and seemed to forbid their return to the earth, which was still invisible. The agitation of the balloon became greater every moment. They cut the cords which held the interior balloon, which consequently fell on the bottom of the external one, just upon the aperture of the tube, which went down into the boat, and stopped it up. At this time the thermometer showed a little above 44°. A gust of wind from below drove the balloon upwards, to the extremity of the vapour, where the appearance of the sun showed them the existence of nature; but now both the heat of the sun and the diminished density of the atmosphere occasioned such a dilatation of the inflammable air that the bursting of the balloon was apprehended; to avoid which, they introduced a stick through the tube that proceeded from the balloon, and endeavoured to remove from its aperture the inner balloon which closed it: but the dilatation of the inflammable air pushed the inner balloon so violently against the aperture of the tube that every endeavour proved ineffectual. During this time they still continued to ascend, until the mercury in the barometer stood not higher than 24·36 inches, which showed their height above the surface of the earth to be about 5100 feet. In these dreadful circumstances they thought it necessary to make a hole in the balloon, in order to give an exit to the inflammable air; and the Duke de Chartres took himself one of the banners, and made two holes in the balloon, which tore open between seven and eight feet. They then descended very rapidly, seeing at first no object either on earth or in the heavens; but a moment after they discovered the fields, and were descending straight into a lake, wherein they would inevitably have fallen, had they not quickly thrown overboard about sixty pounds weight of ballast, which occasioned their coming down at about thirty feet beyond the edge of the lake. Notwithstanding this rapid descent, occasioned by the great quantity of gas which escaped out of the two rents in the balloon, none of the four adventurers was hurt; and it is very remarkable, that out of six glass bottles full of liquor that were simply laid down in the boat only one was found broken.

On the 18th of July M. Blanchard made his third aerial voyage, with the same inflammable-air balloon from Rouen. He was accompanied by one M. Boby; and in the account of the voyage he says, that when they ascended there were 210 pounds of ballast, besides their weight, in the boat. In this voyage M. Blanchard had a barometer and a thermometer, the former of which on the ground stood at 30·1 inches, and the latter at 45°. The wind was north-west. They set off at a quarter past five o'clock in the afternoon from the barracks of Rouen, and in seven minutes' time the barometer fell 4·76 inches, and the thermometer 40°. During the voyage, M. Blanchard says, that by agitating the wings of his boat he often ascended, descended, went side-way, and even, in some measure, against the wind; but one of the certificates says, that, previous to the final descent, M. Blanchard, in order to gratify the spectators, descended and reascended three times at pleasure, by means of the wings. However, this might have been occasioned by merely rebounding on the earth, or by letting out alternately some ballast and some inflammable air; which seems rather likely to have been the case, since, in the voyages which M. Blanchard afterwards made in England, with the same balloon, the wings of his boat in spite of his endeavours seemed to produce no particular effect.

At half an hour past seven they descended safely in the plain of Puissanval, near Grandcour, which is forty-five miles distant from Rouen, 110 pounds weight of ballast still remaining in the boat.

One of the certificates, signed by many persons, testifies, that for this experiment the balloon was filled by M. Vallet in the remarkable short time of one hour and a half. The last certificate that is annexed to the account of this voyage says, that the balloon remained full all the night, and that on the following day, having anchored it by means of ropes, which permitted it to ascend only to about eighty feet, divers ladies ascended successively with it; and they found the experiment far from being dangerous or displeasing.

The balloon was at last evacuated of its gas; to effect which not only the valve was opened, but a great aperture was made towards the inferior part of the balloon, which was laid on its side and pressed; and yet more than an hour was required to empty it; from whence may be concluded, that if a rent of three feet should be made in such a balloon, whilst in the atmosphere, the loss of inflammable air would not be sufficient to occasion a dangerous fall.

Cavallo now gives an account of Lunardi's, as the first aerial voyage in this country; but I prefer inserting Lunardi's own letters, as they are lively, and depict London society of that day. This priority, moreover, was owing to the slowness of intelligence; for in the *Public Ledger* of August 16th (1784), we read that, on August 9th,

An attempt was made to launch a fire-balloon from the Comely Gardens, Edinburgh; but just as it had been filled, and Mr. Tytler was about to take his seat in the basket, one of those unlucky accidents, which hitherto have never failed to attend every proposed exhibition of this aerial machine, took place. The consequence was a relinquishment of the project for the present.

However, on August 27th, the following letter was written to and inserted in the *London Chronicle*:—

Edinburgh, August 27, 1784.

Mr. Tytler has made several improvements upon his fire-balloon. The reason of its failure formerly was its being made of porous linen, through which the air made its escape. To remedy this defect Mr. Tytler has got it covered with a varnish to retain the inflammable air after the balloon is filled.

Early this morning this bold adventurer took his first aerial flight. The balloon being filled at Comely Garden he seated himself in the basket, and the ropes being cut he ascended very high, and descended quite gradually on the road to Restalrig, about half a mile from the place where he rose, to the great satisfaction of those spectators who were present. Mr. Tytler went up without the furnace this morning; when that is added he will be able to feed the balloon with inflammable air, and continue his aerial excursions as long as he chooses.

Mr. Tytler is now in high spirits, and in his turn laughs at those infidels who ridiculed his scheme as visionary and impracticable. Mr. Tytler is the first person in Great Britain who has navigated the air.

It is remarkable that the 'Gentleman's Magazine' (vol. liv. part ii. pp. 709 and 711) should accurately chronicle both ascents, and yet speak afterwards of Lunardi's as the first, when the dates speak to the contrary.

To Tytler, therefore, belongs the title of the *first Aeronaut in Great Britain*; and, with the exception of Mr. Smeath, in 1837, he was also the first, and the only one, to use a Montgolfière in this country.

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I will now give Vincent Lunardi's account of his 'First Aerial Voyage in England' (1784), published in a series of letters to his guardian, Chevalier Compagni. Lunardi was secretary to the Neapolitan ambassador, Prince Caramanico, to which circumstance his presence in England was at this time due. His letters were written in a flush of excitement; or, as he says, "under the impressions of the various events that affected the understanding."

LETTER I.

My honoured Friend,— London, July 15, 1784.

The innumerable instances of kindness I have received from you, and the respectful affection it has impressed on my mind, have insensibly led me into the habit of giving all my interesting thoughts and actions some reference to you, and making your opinion and satisfaction necessary to my happiness.

You are well apprised of the general effect which the attempts to perform aerial voyages in France, have had in Europe; but you may not know that the philosophers in England have attended to them with a silence, and apparent indifference, not easily to be accounted for.

These two nations emulate each other in all circumstances. And the progress and advantage of manufactures are not watched on either side with greater anxiety and jealousy, than a discovery in science, or an improvement in fine arts. This has the happiest effect, as it is accompanied with a liberality and candour that do honour to human nature.

The first rumours of aerial voyages were so swollen by the breath of fame, and the imaginary advantages to attend them, so rapidly and plausibly multiplied, that the genius of English philosophy, which, since the days of Newton, has borne the palm of science, clouded her brows with a kind of sullenness, and perhaps feared for a moment the ascendancy of her sister.

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director*

1864

The glory of a discovery is indivisible as the atoms of Epicurus; and in respect to aerostation, it remains, and must remain with France. It is supposed, and I speak it on better authority than rumour, that some of the most attentive and penetrating observers in England meditate such improvements of Aerostatic Balloons, and such modes of applying them to use, as may give them an equal claim to glory with their philosophical rivals in France. But this has not hitherto been attended with any remarkable effects.

You will possibly wonder, that in such circumstances, at my age, with the numerous engagements and occupations of my office, not yet distinguished in the records of science, and but little known in a country so enlightened as England, I should have the ambition to be the first man who visited its atmosphere.

I have already acquainted you with the project of our friend Zambeccari, and the reason of its failure. Little disappointments and errors are often the means of instruction. I proceeded in a different method, and conceived the design of interesting generosity and humanity, in the patronage of an experiment of some hazard, particularly in the hands of a foreigner.

At the distance of two miles from this metropolis stands a monument of liberal and prudent charity, first suggested (as it is said) to Charles II. by a licentious woman. It is the hospital of military invalids at Chelsea; an object of national attention; and managed with a respect to the intentions of the successive princes who have patronised it, and to the health and comfort of the meritorious veterans who inhabit it, which are not common in national institutions.

This building consists of three sides of a spacious quadrangle: a garden sloping before it to the shore of the Thames; the vale extensive and fertile, and bounded by hills gently rising, highly cultivated, and beautifully marked with villas, churches, and villages, all indicating the opulence and felicity of the inhabitants.

This I have fixed upon, in my mind, as a picturesque and propitious spot; and I wish, as it were from the altar of humanity, to ascend the skies.

I have, therefore, addressed the following request to Sir George Howard, governor of the hospital:—

"Mr. Lunardi has the honour to acquaint Sir George Howard, that he intends to construct an Air Balloon, in which he will ascend for the purpose of making some interesting experiments. But previous to his engaging in so expensive an undertaking, he wishes to be assured of a place for launching it, to which none but subscribers can be admitted. If Sir George Howard will indulge him with his permission to launch it from Chelsea gardens, Mr. Lunardi proposes to devote whatever may exceed the expense of the undertaking to be divided among the invalids of the hospital. Mr. Lunardi requests the favour of an answer from Sir George Howard."

The King of England is distinguished for an attention to the minutest variations in the state of science or the arts, as he is for an unblemished character, and the most scrupulous practice of all moral and religious obligations. The innumerable concerns of an empire, to which extent and unwieldiness alone have been an inconvenience, do not prevent his personal notice of any remarkable character, or his correct examination of any scientific event.

He has had the condescension to attend to the first probable intimations of a successful experiment with balloons, and the governor, with His Majesty's approbation, has granted my request.

I know your friendly and parental bosom will have some emotions at the opening of a design, by a youth whom you have so long cherished and loved, which leads to glory through some uncertainty and some danger. But my resolution is taken, and you know, within the bounds of life, nothing can shake it.

When I write to you, though at such a distance, I discharge a duty. It seems to have the effect of my usual methods of consulting you. I obtain my own approbation, and collect firmness and resolution, where perhaps I had my difficulties and doubts, and I take you with me in everything I do. This habit is favourable to my slumbers, which I find to be a little interrupted by the magnitude of my design. I will therefore avail myself of its influence.

Good night, my dearest and best friend, communicate my intelligence to my sisters, &c., and believe me to remain your obliged and affectionate

VINCENT LUNARDI.

## LETTER II.

MY DEAR FRIEND, London, August 2, 1784.

I know your anxiety to learn the progress of my undertaking.

Neither my fortune nor my economy have ever allowed me to be in affluence; I therefore enter on any business requiring expense with some disadvantage. In Italy I should have sought the patronage and generosity of my

Sovereign, or of some liberal and opulent nobleman, to enable me to sustain the expense of my present undertaking. Here wealth is more equally diffused; and by any contrivance that can gratify the curiosity of the people, sums of money are immediately collected, without the anxiety and mortification of petitioning the great. This has, in some measure, banished patronage from England; but ingenious men are perhaps the better rewarded, and are not rendered slaves to the purposes and caprices of patrons. Hence are innumerable exhibitions, which are always open in London, and which are means of circulation, convenience, information, and utility, almost unknown in every other country.

To proceed in my design I have been obliged to adopt this custom. You will not be offended that a secretary to an embassy exhibits his balloon, when you know that the first artists in the nation, under the immediate protection of the King, and incorporated into an academy, exhibit their pictures yearly, and that the price of admission is one shilling. This expedient adds two or three thousand a year to the income of the Academy, and is neither an inconvenience nor a dishonour, where the diffusion of wealth through the lowest ranks renders the whole nation the general patron of useful designs.

In the centre of London, and in a street called the Strand, because it runs by the edge of the Thames, there is a large room constructed for the exhibition of pictures, by the first society formed in England for the encouragement of painting and sculpture.

Italians viewed this society, and every other of a similar kind, as the Europeans do the establishment of manufactories in America. The English had been accustomed to send their youth to Italy to learn just so much of the fine arts as would enable them to purchase and imitate its productions. At this time there are names in England which are equal in reputation to any in the world. This, however, is greatly owing to the patronage afforded by His Majesty, who has instituted an academy for sculpture and painting, and who is himself the best judge in his dominions of the productions of his artists.

The institution of the Academy gradually weakened and destroyed the Society, and their room has since been fitted up for a species of entertainment which no country ever produced but England; that is, a debate on political subjects, continued at random by any man who would pay for his admission, and speak so as to amuse the assembly. In reference to this entertainment, it was called the Lyceum; and in that Lyceum I exhibit my balloon.

As the minutest step I take is interesting to you, I shall send you some of my proposals and advertisements just as they appear.

"ADVERTISEMENT.

"I take the liberty to acquaint , that I have undertaken the construction of a globe of thirty-two feet in diameter, with which I intend to ascend, as soon as completed, to make the most interesting experiments, especially that of going many miles before the wind, and keeping the globe constantly not higher than a gun-shot, previous to my constructing the great machine for direction.

"Being already involved in great expenses attending the construction of so large a globe, made with the best oiled silk,—the filling it with inflammable air, the machinery for the experiments, &c.,—I am obliged to solicit the assistance of the liberal promoters of ingenuity, in an undertaking of so curious a nature. By the improvements I flatter myself to have invented, I hope to render the discovery of great public utility; and presume to request you will have the goodness to honour me with your support and subscription; as approbation of my scheme may have weight with others, and induce them to conceive the practicability of it.

"The gallery, oars, and wings are already made, and to be seen at the Lyceum, Exeter-Change, Strand, where the balloon is now constructing, and will be finished in about a fortnight: with which, when completed, I intend to set off from Chelsea Hospital Garden, having already obtained His Majesty's patronage, and Sir George Howard's permission.

"Subscriptions are taken in at Mr. Debrett's, Bookseller, opposite Burlington-house, Piccadilly; Mr. Booker, Stationer, No. 56, New Bond-street; Mr. Barnes, Engraver, Coventry-street, Haymarket; Mr. Adams, Mathematician to His Majesty, No. 60, Fleet-street; and also at Messrs. Nairne and Blunt, Mathematical and Philosophical Instrument-makers, No. 20, Cornhill, opposite the Royal Exchange. Which Mr. Lunardi will give his receipt for.

"The guinea subscribers will be admitted into Chelsea Hospital Garden, and have a chair near the globe the day of ascending, and may view the construction at the Lyceum four different times.

"A half-guinea subscriber will likewise be admitted into the Garden on the above day, and also be accommodated with a seat on benches, next to the chairs, and admitted twice to see the construction of the machine."

The probability that my design would be executed produced, what hardly any recommendatory letters or other common means of introduction will do in England, I mean an acquaintance with persons of merit and consequence. England is open to all the world, either in war or peace; and a man of talents, whether liberal or mechanic, cannot fail of support and encouragement in proportion to his merit. But it would be wholly useless to bring to London such letters of recommendation as would in any city on the continent enable a man to run through almost all the houses in it. Here the prodigious resort of strangers has nearly destroyed that indiscriminate species of hospitality which prevails on the continent; and which, while it may be agreeable to those who travel to get rid of time, has not sufficient utility to atone for its inconvenience. But when once a circumstance in the situation or character of a stranger has attracted the notice of an Englishman, and he has declared himself his protector and friend, it is worth a thousand of the civilities of general hospitality; a reliance may be had on its sincerity; and the friendship is permanent in duration as it is slow in growth.

Sir Joseph Banks is among the first persons who have taken notice of my design; and he has honoured my subscription with his name. The reputation he has acquired as the first botanic collector in the world; as the friend and companion of Captain Cook, in one of his voyages round the globe; as the President of the Royal Society, and the general patron of knowledge and merit, renders any account of him to you unnecessary.

My subscription, however, comes in but slowly; nor has the balloon, though larger, constructed of better materials and on better principles than any that has yet appeared in England, excited the curiosity I expected. This is partly owing to some ridiculous exhibitions of the kind which have been had at the same place, and which have diffused a disposition to incredulity and suspicion.

My balloon is composed of oiled silks, of which five hundred and twenty yards are inserted in alternate stripes of blue and red, which give it a very lively and pleasing appearance. Its form is spherical. The horizontal dimension of it is thirty-three feet; its circumference one hundred and two. It is kept suspended, and at present is filled with common air only, which I inject with bellows, through tubes of oiled silk that pass through its sides. More than two-thirds of the globe are covered with a strong net, from which depend forty-five cords, forming equal sections on its lower part, and uniting at the bottom. These will be fastened to a circular frame, that forms the upper part of the vehicle in which I mean to perform my Aerial Voyage. It will be furnished, likewise, with wings and oars; the use of the former is to excite air when the globe is becalmed, and thereby to move it horizontally; they have the form of large rackets, and are covered with loose flounces of oiled silk. The oars, which differ from the wings only in size, will be worked with a vertical motion, and are intended to effect a depression of the machine; by which I hope to be enabled either to check its ascension, or to descend without the necessity of letting out the inflammable air.

I exhibit these, not only as matters of curiosity to persons who have not seen or understood the French experiments, but to point out to those who have the peculiar object of my enterprise. For I have the ambition to be the first not only to visit the English atmosphere, but to ascertain the practicability of rendering the balloon stationary, or descending at pleasure by means of oars, acting vertically, and superseding the use and necessity of valves. In this only circumstance I aim to deviate into originality from the splendid and successful track of the French philosophers.

There are two methods of filling a balloon for ascension; and it is remarkable, that the method first discovered and executed by Messrs. Montgolfier, is the most hazardous and difficult to apply to use. It is effected, as a chimney is heated, by a common fire; and a balloon of this kind is a moving chimney, closed at the top, made of light materials, and raised by the elasticity which is always given to air by fire.

This requires a constant application of fire to the contents of the balloon, which is a difficult operation; and the least error in the application may be the occasion of consuming the apparatus and endangering the lives of those who trust to it.

I have chosen inflammable rather than elastic air for my guide. It is a substance produced by the action of vitriolic acid on metals or semi-metals, and is similar to that vapour (carburetted hydrogen) which takes fire in mines, and carries terror and destruction wherever it approaches. This you will say is changing one hazardous instrument for another; but the chances of setting fire to the elastic balloon, or of not applying the heat so equally as to answer the purposes of ascension, are numerous; those of exploding an inflammable balloon arise

only from thunder-clouds; and, if proper attention be paid to the weather, they are not numerous or difficult to be avoided. Besides, inflammable air being seven times lighter than atmospherical air, and rarefied air not more than three times lighter, the machine must of course be proportionably larger in the use of the latter than in that of the former.

My design to use inflammable air has been the occasion of my acquaintance with Dr. George Fordyce, a physician of eminence, a lecturer in chemistry, and probably the first chemist in the island. I consider this as a very fortunate circumstance; for, besides the improvement and satisfaction I derive from his friendship, he has offered in the kindest manner to fill the balloon in a method which is an improvement on that of the French philosophers, as he contrives the tubes for conveying the inflammable so as to prevent the admission of any atmospheric air. He is also of opinion, that air produced by the vitriolic acid and zinc alone is the lightest of any that has been yet used.

But, in the leading incidents of this era of my life, I must reckon among the happiest my introduction to Mr. Biggin, a young gentleman distinguished by his birth, education, and fortune; of improved and elegant accomplishments, a strong lover of science, and of a liberal and affectionate heart. This young gentleman, in the first days of our acquaintance, expressed a wish to accompany me in my ascent. And as the regions I intended to visit are unknown, and Mr. Biggin's talents so useful and engaging, I have accepted his offer. The voyage will, by this circumstance, be rendered more interesting; we shall direct our particular attention to different objects; and, in any of those incidents which novelty may render astonishing, we shall communicate and multiply our joy, or lessen and remove our apprehensions.

I am, &c.,

VINCENT LUNARDI.

## LETTER III.

MY DEAR FRIEND, London, August 18, 1784.

The events of this extraordinary island are as variable as its climate. You here experience the extremes of elevation and dejection, as you do of heat and cold in a shorter time, and in a greater number of occurrences, than in any country I know in the world. When I wrote you last, everything relative to my undertaking wore a favourable and pleasing appearance: I am at this moment overwhelmed with anxiety, vexation, and despair.

On advertising my intention to go up with my balloon, it was natural to suppose that any latent ambition of the same kind would show itself, and perhaps spring forward to seize the applause attending the execution of such an enterprise. I do not say that this would not have disappointed me, but it would not have left me in any situation of distress like the present.

A Frenchman, whose name is Moret, and who may possibly have assisted at some trials at Paris to launch balloons in the manner of Montgolfier, advertised as it were in competition with me; and fixed on a day for ascending with his balloon, previous to that on which I had the permission of Sir George Howard to make my excursion from Chelsea Hospital.

To hasten my own undertaking would have been entering into a ridiculous race with Moret; and if I had been inclined to such a measure it was probable that the day appointed for me would not have been changed without a better reason than could have been assigned from the competition. I therefore waited, with as much patience as I could command, the event of Moret's experiment; imagining, however, it would fail, from a view of the balloon; but having no apprehension of such consequences as might involve my disappointment or my ruin.

On the 11th of August his advertisements assembled a company of three or four hundred persons in a Garden at Chelsea; and, unfortunately for me, at a small distance from the Hospital where I was permitted to exhibit. The gardens and fields around the place were crowded with fifty or sixty thousand people, not so much from economy as incredulity and suspicion of the undertaking. That was greatly owing to his manner of anticipating my design, which threw on him and me, undeservingly, the imputation of imposture.

From one to four o'clock the company waited with patience the filling and ascension of the balloon; and when every effort was seen to fail, and the balloon sank into the fire which expanded it, the mob rushed in, tore it in a thousand pieces, robbed many of the company, levelled with the ground all the fences of the place and neighbourhood, and spread desolation and terror through the whole district.

I saw into many of the consequences which would affect my own undertaking. Though the people of England are comparatively well-informed and enlightened, yet the multitude in all nations is nearly alike. The misfortune of Moret was attributed to imposture; and a suspicion of a similar nature was extended to me. I felt all the

immediate inconveniences of guilt, as you will see by the following copies of letters; though nothing could be farther from my thoughts than any intention to be concerned in an imposition :—

"SIR, "Chelsea Hospital, August 14, 1784.

"It having been represented to the governor of this place, that a riot was occasioned by an attempt to raise an Air Balloon in this neighbourhood on Wednesday last, I have his orders to acquaint you that it is impossible he can, on any consideration, subject this College to the insults of a mob; and at the same time he directs me to say how disagreeable it is to him to refuse his consent, but that his determination is unalterably fixed. I have the honour to be, Sir, &c.,

"WM. BULKELEY."

On the receipt of this letter I waited on Major Bulkeley, and, describing the hardship of being involved in the consequences of the faults or misfortunes of another, I prevailed on him to represent my situation to the governor. In consequence of which I received this final resolution of Sir George Howard :—

"SIR, "Chelsea College, August 17, 1784.

"I have this moment received a letter from Sir George Howard, in answer to one I wrote to him on Monday last, after I had the honour of seeing you, and he desires me to acquaint you that he must again repeat the impossibility of his consenting to the exhibition of your Air Balloon in any place belonging to Chelsea College; his duty absolutely forbids it, and no consideration shall make him do it after what happened last week. That he is very sorry you should meet with any disappointment, but that nothing shall make him do what he cannot justify, *and that, at all events*, it cannot take place at Chelsea College, and, therefore, that it is absolutely necessary you should look out for some other place, and give notice of it in the public papers.

"I have the honour to be, Sir, &c.,

"W. BULKELEY."

I am now sunk into the utmost depth of distress. Though I may be said to have no reputation to lose in a kingdom where I am scarcely known, I yet experience the most poignant mortification at seeing my hopes destroyed, and myself, in the slightest degree, suspected of anything inconsistent with honour, and an ardent love of science.

You will say it is an imputation on the character of an enlightened kingdom to prejudge an experiment which has not been made, especially as I propose to do only what has been proved to be practicable in France. I have already told you that everything respecting Air Balloons has been admitted here with reluctance; the pompous accounts of French voyages are credited, after making large allowances for Gallic vanity; and all hypotheses respecting a certain and useful application of the discovery are considered as romantic visions. This prepossession, however, does not prevent philosophers and men of letters here from discerning the practicability of everything that has been effected in France. But they are not much more numerous in this than in other nations; they do not always regulate the opinions of the people, and, in this case, they are not very desirous of undeceiving them. The national prejudice of the English against France is suffered to have its full effect on a subject from which the *literati* of England expect to derive but little honour; an unsuccessful attempt has been made by a Frenchman; and my name being that of a foreigner, a very excusable ignorance in the people may place me among the adventurers of that nation, which are said to have sometimes distinguished themselves here by ingenious impositions.

I am apprehensive, therefore, I must relinquish my undertaking, after an expense which my circumstances can ill bear, and when the satisfaction and glory of accomplishing it are just within my reach.

Adieu, my dear friend, I regret the necessity of leaving on your mind the melancholy impressions which this letter must make. You may depend on it I shall conduct myself in every event with a proper recollection of your solicitude and regard for me. For I shall ever remain

Most sincerely yours,

VINCENT LUNARDI.

## LETTER IV.

My honoured Friend, London, September 14, 1784.

I still have hopes: for what philosophers dare not attempt, the ladies easily accomplish. They can smile into acquiescence that uncouth monster,—public prejudice; and they regulate the opinions and manners of a nation at pleasure.

My perseverance amidst the difficulties and supposed dangers which surround me, in consequence of the failure of Moret, has given me an air of heroism which you know interests the fair sex. The Lyceum, therefore, is crowded with company, and particularly ladies, who take for granted I am to ascend; many of them wish I were not engaged to Mr. Biggin, that they might accompany me; and with that bewitching air of sincerity which is almost peculiar to the women of this country, and which I think more difficult to resist than the coquetry of my own, they express a tender concern for my safety, which fixes my determination: and I will ascend, if I do it from the street.

I have a prospect of being accommodated with an inclosed piece of ground, which is appropriated for the exercise of a body of armed citizens, viz., the Honourable Artillery Company. This corps is composed of all the officers of the six regiments of the London Militia, and other gentlemen to the amount of five hundred. It is a collection or assemblage of officers, all independent, in officers' uniforms, who, in case of emergency, might exercise in a month twenty thousand men. His Royal Highness the Prince of Wales is Captain-General, and Sir Watkin Lewis, one of the representatives in Parliament for the city of London, is their colonel. To this gentleman I have made application, and the Rev. Mr. Kirwan, chaplain to the embassy, whose friendship upon this, and every other occasion, I shall ever remember with gratitude, did me the honour to wait upon him, and represented the consequence of my disappointment of Chelsea Garden, and the very great expenses I have been at; and that, unless the Honourable Artillery Company would take me under their protection, I could get no proper place for the experiment, from the apprehension of riots and disturbances. Sir Watkin heard his representation with candour, and after inquiring into the principles on which my balloon was constructed, the reasons of the failure of Monsieur de Moret, and attending to every information on the subject which could be given by Doctor Fordyce, Mr. Biggin, and me, he promised to lay my application before the Court of Assistants of the Artillery Company.

The honourable mention he was pleased to make of me, and of my endeavours to promote science by executing the experiment,—the support he gave my application, and the liberality with which he acted, and which distinguish his character,—demand my warmest thanks. You would be astonished at the apprehensions and prejudices excited even in this respectable body, by the failure of De Moret. In vain did Sir Watkin recommend to them to exercise their own judgment; a violent debate took place; and the concession was carried only by his casting vote. I had been led by policy as well as inclination to connect charity with the other motives, which might induce the English to favour my enterprise. I engaged to give a hundred guineas to the family of the late Sir Bernard Turner, as an inducement to the Court of Assistants to grant me the Artillery Ground to receive my company, and to launch my machine. Another Court was called, which was necessary to confirm the proceedings of the former; that was numerously attended, and the proposal again carried by the casting vote of Sir Watkin Lewis.

In consequence of this grant from the Honourable Artillery Company, I published the following advertisement:—

"Grand Air-Balloon, with which Mr. Lunardi and an English Gentleman are to ascend into the Atmosphere.

"Mr. Lunardi is extremely happy to have it in his power to inform the public that, in consequence of an application made to the Honourable Artillery Company, they have been so kind as to accommodate him with the use of their ground, for the purpose of executing the experiment he has undertaken, with this condition annexed, that he shall pay one hundred guineas, to be added to the subscription for the children of the late Sir Bernard Turner. The very laudable and benevolent motive which influenced the Honourable Company to make this demand, was of itself sufficiently operative on the feelings to remove every objection on the part of Mr. Lunardi to a proposal that flowed from the impulse of philanthropy and the cause of humanity. Mr. Lunardi wishes to testify his gratitude in the warmest manner to the public, and will feel a pleasure inexpressible in being able, by their means, to contribute to the relief of distress, and in particular that of the family of so respectable an individual as Sir Bernard Turner. He desires to return his sincere thanks to the Honourable Artillery Company for the great civility he has received

from them, and particularly for the favour of resolving to appear under arms, for the purpose of preserving order and regularity on the day of his balloon being launched. He has the highest sense of the honour they intend him, and the additional satisfaction of acquainting the public that the three avenues leading to and from the Ground, as well as the outside of the gates, will be guarded by the sergeants of the City Militia and the peace-officers, in order to render the access to the Artillery Ground easy and convenient to his subscribers, and to all others who may be led to favour him with their presence on that day, which is determined to be Wednesday, the 15th instant, between twelve and one o'clock, if the weather permits.

"As Mr. Lunardi is desirous to prevent confusion, he has determined that no money shall be taken at the gates of the Artillery Ground, or any person admitted without tickets, which are now issuing at the office adjoining to the *Lyceum* at one guinea, half-a-guinea, and five shillings.

"Tickets, which have already been delivered for Chelsea Hospital Garden, will admit the bearers into the Artillery Ground."

At this time upwards of twenty thousand persons had attended the exhibition of the balloon and apparatus at the Lyceum; and I had no doubt the proprietor of the room, who had received the money, and who had made such a bargain that the pecuniary advantage was to be his, and the hazard and loss to be mine, would immediately enable me to fulfil my agreement with the Artillery Company, and remove the balloon and apparatus to the Ground. But I was mistaken. There are men like sharks, who, by devouring, seem only to be rendered insatiable; and those men are not peculiar to the Jewish nation.

If there were not a probability that these letters may appear in England, I would lay open the whole of this transaction, and the character of the man with whom I unfortunately became connected. But though the English boast of the liberty of the press, they enjoy it with such exceptions as are difficult to be understood by a stranger. Indeed it is not understood by themselves, for they are ever debating the subject. One of the exceptions to the liberty of writing and speaking, and which nearly annihilates it, is, that *truth* constitutes, or is at least an aggravation of a libel. Satirists, therefore, in this country are strictly confined to *falsehood;* and in this it is very possible they may yield obedience to a learned judge's opinion of the law. It is possible, however, that this celebrated lawyer [Lord Mansfield?], being at the head of the King's Bench, may only aim to wrest from the press the adjudication and punishment of every species of delinquency; and that he considers reciprocal defamation and injury in the public papers like duelling, an appeal from the laws to the passions of individuals. Be this as it may, I shall err on the best side, if I err at all, by avoiding expressions of resentment against a character too insignificant for public notice, and too fixed in its habits to be amended by reprehension. It will be sufficient to say that he attempted to take cruel advantages of my situation, and proposed such conditions of assistance as I must have been insane to accept.

What to do in these circumstances I was at a loss to imagine. Fatigue, agitation of mind, and that kind of shame which attends a breach of promise, however involuntary, induced me to send an apology to the committee of the Artillery Company, instead of waiting on them myself. Conceiving this an attempt to deceive them, they rescinded their former resolution respecting the appearance of the men under arms, and ordered the materials for fixing and preparing the balloon which had been sent to be thrown out, unless I paid the hundred guineas the next morning, and found securities in five hundred pounds to indemnify the Artillery Company for any injury that might be done to the premises.

Difficulties generate difficulties. The man at the Lyceum, apprised of the resolutions of the Artillery Company, locked up my balloon and apparatus, and declared they should never be removed until I consigned to him a moiety of all the possible advantages which my present and *future* enterprises of a similar kind might produce. Moderate oppression might have ruined me. Enormous injustice rouses and interests the generous and humane. My case was soon known; I was enabled to send the money; Sir Watkin Lewis and Mr. Kirwan were kind enough to become securities to the Artillery Company. The magistrates of the police took me under their protection, warranted me in forcibly wresting my balloon out of the Lyceum, and also protected me in conveying it to the Artillery Ground on Tuesday, the 14th, under a guard, which was ordered by Sir Sampson Wright and William Addington, Esq., in a manner that did honour to their personal as well as official characters.

Behold me—I was going to say—but I should be extremely sorry if you were to see me, exhausted with fatigue, anxiety, and distress, at the eve of an undertaking that requires my being collected, cool, and easy in mind. The difficulties thrown in my way have postponed all my preparations; and indisposed and exhausted as I

am, I cannot avoid paying such attention to the operations of this night as will allow me but little sleep. Doctor Fordyce is applying his ingenious apparatus to fill the balloon. The process is admirable, though slow; but, I hope by attending to it all night, I shall keep my appointment with the public to-morrow.

Adieu, my honoured and respectable friend; my health and spirits are injured by a series of unfortunate and cruel incidents, but if I succeed I shall be abundantly rewarded. I am, &c., yours,

VINCENT LUNARDI.

## LETTER V.

MY DEAR FRIEND, London, Wednesday, 15.

The auspicious morning is arrived, and I will write the occurrences of it as they arise, lest any of those *supposed impossibilities* overtake me which have lately haunted my designs. I have no apprehension but of the populace, which is here, as it is everywhere, an impetuous, impatient, and cruel tyrant. A disappointment is an offence, whatever be the occasion; and offenders, in every degree, are punished with the same species of injustice. The practicability of the experiment, though perfectly known to philosophers and men of letters, is not believed by the populace; and I have their prejudices to remove, at the risk of that resentment and violence which Sir George Howard did not choose to encounter, even at the head of the veterans of the British army; which have made the Artillery Company doubt, hesitate, resolve, and re-resolve; and which will prevent those who would wish to encourage me from entering the ground.

*Twelve o'Clock.*—The view from the upper apartments of the Artillery House, into which I sometimes retire, is striking and extraordinary, and serves to animate my imagination for scenes more extensive and picturesque which I shall soon survey.

The fear of the populace, in case of a disappointment, has, as I expected, prevented my having much company in the Artillery Ground. But the windows and roofs of the surrounding houses, scaffoldings of various forms and contrivances, are crowded with well-dressed people, and form a singular, and to me very interesting spectacle. They have viewed for hours, with fixed and silent attention, the bustle around the apparatus, and the gradual expansion of the balloon. On my left, in a square, or rather parallelogram, the largest I know in Europe, a part of the populace of this immense place is collected into one compressed and impenetrable mass. The whole would suggest to a tyrant the idea of a pavement of human heads; but I conceive the risk of going up in my balloon trifling, compared with that of attempting to walk on the living surface I now contemplate. One hundred and fifty thousand countenances have all one direction; but I have reason to be anxious not to disappoint such a multitude, every one of which has been wedged in a painful situation the whole morning. You will think me whimsical, perhaps, in fixing my imagination at this time on a public institution of any kind. The principal area which contains the populace is bounded by an extensive and noble building, devoted to the most compassionate and affecting of all the offices of benevolence. It is a retreat for the insane who are not judged incurable, and it is called Bedlam. The arrangement, extent, and wholesomeness of the apartments, the assiduity and care of the governors, physicians, and apothecaries, and the unabating liberality with which it is supported, render it an object of universal respect. The figures of Frenzy and Melancholy at its gate are celebrated throughout Europe, and are deemed barely inferior to the admired productions of Greek sculpture. Which of these allegorical beings the people have assigned as my patron I have not learned. I suppose they may be divided; but they agree in the propriety of making my attempt near Bedlam, as the event, in their opinion, will render it necessary to convey me there. How happy should I be if some kind spirit would instruct me to emulate Astolpho * on his flying horse, and to explore those regions where the straying wits of mortals betake themselves! But this is not a time for even benevolent reveries, and I indulge them in any degree to repel unwelcome apprehensions.

*Half after One.*—The time fixed for my departure is elapsed, but the balloon is not sufficiently filled for the purpose. The populace have given some intimations of impatience, and I may yet be pre-judged before I make my attempt. The presence of the Prince of Wales, and the obvious satisfaction with which he views the progress of the preparations, may remove the suspicion of deceit, and restrain the impetuosity of the people. The condescending affability of the Prince, and the interest he deigns to express, by repeated wishes for the safety of

* Vide Ariosto's 'Orlando Furioso,' where the English knight is said to have mounted to the moon, to bring back the wits of Orlando. Query, Are not the fables of flying horses, dragons, &c., presumptions that the principle of air-balloons is not a modern discovery? (See p. 11-14 of this work.)

Mr. Biggin and me, are pleasing alleviations of my present anxiety. His Royal Highness remains near the apparatus, without going to the company in the house. Those who attend him pay their court, and I dare say express their real sentiments by anxieties for his safety. They apprehend dangers from the apparatus and from tumults: his Royal Highness apprehends none, for he is really better informed, asks questions with more judgment, and directs his curiosity in a better manner than is usual to persons of his high rank and his early years. He seems now and then to express his wishes for our safety, as if not destitute of doubt. Indeed the whole company view us with a kind of regret, as devoted persons, whose return is at least problematical. This is pleasing to us only as it is a proof of polite humanity. We are not under the slightest apprehensions of danger when once committed to the balloon. I must own the concern betrayed by the looks of my friends, though I know it to be without reason, has a considerable effect on me. Prince Caramanico, my kind patron and benefactor, is evidently under some apprehension; and I shall remember, my whole life, this unequivocal proof of his friendship. As those who interest themselves in my fate bid me adieu in the most expressive, though silent manner, I thus take my leave of you. Whatever becomes of me, I know this testimony of my respectful regard will be affectionately received by you. Adieu, my honoured friend. I will conclude my letter on my return.

Friday Evening, 24th September.

I was this morning to have been presented to the King, but the anxiety and fatigue I had endured exhausted my strength and spirits in such a manner as to occasion a violent fit of sickness, which confined me to my bed, and deprived me of the honour and satisfaction I had promised myself on the occasion.

This is the first moment since my excursion I have been able to take up my pen with the probability of giving you an account of it, and I am determined the post shall not go out this evening without it.

A little before two o'clock on Wednesday, Mr. Biggin and myself were prepared for our expedition. His attention was allotted to the philosophical experiments and observations, mine to the conduct of the machine and the use of the vertical oars in depressing the balloon at pleasure.

The impatience of the multitude made it unadvisable to proceed in filling the balloon, so as to give it the force it was intended to have. On balancing that force with weights, it was supposed incapable of taking us up. When the gallery was annexed, and Mr. Biggin and I got into it, the matter was beyond doubt; and whether Mr. Biggin felt the most regret in relinquishing his design, or I in being deprived of his company, it may be difficult to determine. But we were before a tribunal where an instantaneous decision was necessary; for hesitation and delay would have been construed into guilt; and the displeasure impending over us would have been fatal, if in one moment he had not had the heroism to relinquish, and I the resolution to go alone.

This event agitated my mind greatly; a smaller gallery was substituted; and the whole undertaking being devolved on me, I was preparing accordingly, when a servant brought me word that an accident had befallen the balloon, which would prevent my intended voyage. I hastened down, almost deprived of my senses; and though I was instantly convinced that the injury was trifling, I could not recover the shock in time to recollect that I should supply myself with those instruments for observation which had been appointed to Mr. Biggin. I threw myself into the gallery, determined to hazard no further accidents that might consign me and the balloon to the fury of the populace, which I saw was on the point of bursting. An affecting, because unpremeditated, testimony of approbation and interest in my fate was here given. The Prince of Wales and the whole surrounding assembly, almost at one instant, took off their hats, hailed my resolution, and expressed the kindest and most cordial wishes for my safety and success.

At five minutes after two the last gun was fired, the cords divided, and the balloon rose, the company returning my signals of adieu with the most unfeigned acclamations and applauses. The effect was that of a miracle on the multitudes which surrounded the place; and they passed from incredulity and menace into the most extravagant expressions of approbation and joy.

At the height of twenty yards the balloon was a little depressed by the wind, which had a fine effect; it held me over the ground for a few seconds, and seemed to pause majestically before its departure.

On discharging a part of the ballast it ascended to the height of two hundred yards. As a multitude lay before me of a hundred and fifty thousand people who had not seen my ascent from the ground, I had recourse to every stratagem to let them know I was in the gallery, and they literally rent the air with their acclamations and applause. In these stratagems I devoted my flag and worked with my oars, one of which was immediately broken, and fell from me. A pigeon, too, escaped, which, with a dog and cat, were the only companions of my excursion.

When the thermometer had fallen from 68° to 61° I perceived a great difference in the temperature of the air. I became very cold, and found it necessary to take a few glasses of wine. I likewise eat the leg of a chicken; but my bread and other provisions had been rendered useless, by being mixed with the sand which I carried as ballast.

When the thermometer was at 50° the effect of the atmosphere and the combination of circumstances around produced a calm delight, which is inexpressible, and which no situation on earth could give. The stillness, extent, and magnificence of the scene, rendered it highly awful. My horizon seemed a perfect circle; the terminating line several hundred miles in circumference. This I conjectured from the view of London, the extreme points of which formed an angle of only a few degrees. It was so reduced on the great scale before me that I can find no simile to convey an idea of it. I could distinguish St. Paul's and other churches from the houses. I saw the streets as lines, all animated with beings whom I knew to be men and women, but which I should otherwise have had a difficulty in describing. It was an enormous beehive; but the industry of it was suspended. All the moving mass seemed to have no object but myself; and the transition from the suspicion, and, perhaps, contempt of the preceding hour, to the affectionate transport, admiration, and glory of the present moment, was not without its effect on my mind. I recollected the puns* on my name, and was glad to find myself calm. I had soared from the apprehensions and anxieties of the Artillery Ground, and felt as if I had left behind me all the cares and passions that molest mankind.

Indeed, the whole scene before me filled the mind with a sublime pleasure, of which I never had a conception. The critics *imagine*—for they seldom speak from experience—that terror is an ingredient in every sublime sensation. It was not possible for me to be on earth in a situation so free from apprehension. I had not the slightest sense of motion from the machine; I knew not whether it went swiftly or slowly; whether it ascended or descended; whether it was agitated or tranquil, but by the appearance or disappearance of objects on the earth. I moved to different parts of the gallery; I adjusted the furniture and apparatus; I uncorked my bottle, eat, drank, and wrote, just as in my study. The height had not the effect which a much lesser degree of it has near the earth, that of producing giddiness. The broomsticks of the witches, Ariosto's flying-horse, and even Milton's sunbeam conveying the angel to the earth, have all an idea of effort, difficulty, and restraint which do not affect a voyage in the balloon.

He was the first, perhaps, who realised the beauty of Shelley's chorus:—

Cloudless skies and windless streams,
Silent, liquid, and serene;
As the birds within the wind,
As the fish within the wave,
As the thoughts of man's own mind
Float through all above the grave,
We make these our liquid lair,
Voyaging cloudlike and unpent
Through the boundless element.

Thus tranquil, and thus situated, how shall I describe to you a view such as the ancients supposed Jupiter to have of the earth, and to copy which there are no terms in any language? The gradual diminution of objects, and the masses of light and shade, are intelligible in oblique and common prospects. But here everything wore a new appearance, and had a new effect. The face of the country had a mild and permanent verdure, to which Italy is a stranger. The variety of cultivation, and the accuracy with which property is divided, give the idea ever present to a stranger in England of good civil laws and an equitable administration: the rivers meandering; the sea glistening with the rays of the sun; the immense district beneath me spotted with cities, towns, villages, and houses, pouring out their inhabitants to hail my appearance: you will allow me some merit at not having been exceedingly intoxicated with my situation.

To prolong the enjoyment of it, and to try the effect of my only oar, I kept myself in the same parallel respecting the earth for nearly half an hour. But the exercise having fatigued, and the experiment having satisfied me, I laid aside my oar, and again had recourse to my bottle: this I emptied to the health of my friends and

* In some of the papers, witticisms appeared on the affinity of Lunatic and Lunardi.

benefactors in the lower world. All my affections were alive, in a manner not easily to be conceived; and you may be assured that the sentiment which seemed to me most congenial to that happy situation was gratitude and friendship. I will not refer to any softer passion. I sat down and wrote four pages of desultory observations, and, pinning them to a napkin, committed them to the mild winds of the region, to be conveyed to my honoured friend and patron, Prince Caramanico.

During this business I had ascended rapidly; for, on hearing the report of a gun fired in the Artillery Ground, I was induced to examine the thermometer, and found it had fallen to 32°. The balloon was so much inflated as to assume the form of an oblong spheroid, the shortest diameter of which was in a line with me, though I had ascended with it in the shape of an inverted cone, and wanting nearly one-third of its full complement of air. Having no valve, I could only open the neck of the balloon, thinking it barely possible that the strong rarefaction might force out some of the inflammable air. The condensed vapour around its neck was frozen, though I found no inconvenience from the cold. The earth at this point appeared like a boundless plain, whose surface had variegated shades, but on which no object could be accurately distinguished.

I then had recourse to the utmost use of my single oar; by hard and persevering labour I brought myself within three hundred yards of the earth, and, moving horizontally, spoke through my trumpet to some country people, from whom I heard a confused noise in reply.

At half after three o'clock I descended in a corn-field, on the common of South Mimms, Hertfordshire, where I landed the cat.* The poor animal had been sensibly affected by the cold during the greatest part of the voyage. Here I might have terminated my excursion with satisfaction and honour to myself; for, though I was not destitute of ambition to be the first to ascend the English atmosphere, my great object was to ascertain the effect of oars acting vertically on the air. I had lost one of my oars, but by the use of the other I had brought myself down, and was perfectly convinced my invention would answer. This, though a single, was an important object; and my satisfaction was very great in having proved its utility. The fatigues and anxiety I have endured might have induced me to be content with what I had done, and the people about me were very ready to assist at my disembarkation; but my affections were afloat, and in unison with the whole country, whose transport and admiration seemed boundless. I bid them therefore keep clear, and I would gratify them by ascending directly in their view.

My general course to this place was something more than one point to the westward of the north. A gentleman on horseback approached me, but I could not speak to him, being intent on my re-ascension, which I effected, after moving horizontally about forty yards. As I ascended one of the balustrades of the gallery gave way, but the circumstance excited no apprehension of danger. I threw out the remainder of my ballast and provisions, and again resumed my pen. My ascension was so rapid that before I had written half a page the thermometer had fallen to 29°. The drops of water that had adhered to the neck of the balloon were become like crystals. At this point of elevation, which was the highest I attained, I finished my letter, and fastening it with a corkscrew to my handkerchief, threw it down. I likewise threw down the plates, knives, and forks, the little sand that remained, and an empty bottle, which took some time in disappearing. I now wrote the last of my despatches from the clouds, which I fixed to a leathern belt, and sent towards the earth. It was visible to me on its passage for several minutes, but I was myself insensible of motion from the machine itself during the whole voyage. The earth appeared as before, like an extensive plain, with the same variegated surface, but the objects rather less distinguishable. The clouds to the eastward rolled beneath me in masses immensely larger than the waves of the ocean. I therefore did not mistake them for the sea. Contrasted with the effects of the sun on the earth and water beneath, they gave a grandeur to the whole scene which no fancy can describe. I again betook myself to my oar, in order to descend, and by the hard labour of fifteen or twenty minutes I accomplished my design, when my strength was nearly exhausted. My principal care was to avoid a violent concussion at landing, and in this my good fortune was my friend.

At twenty minutes past four I descended in a spacious meadow, in the parish of Standon, near Ware, in Hertfordshire. Some labourers were at work in it. I requested their assistance; they exclaimed they would have nothing to do with one who came in the Devil's house, or on the Devil's horse (I could not distinguish which of the phrases they used), and no entreaties could prevail on them to approach me. I at last owed my deliverance

* Attestations of particular circumstances in this letter have been received since it was written, which the reader may see annexed, in the manner of an Appendix.

to the spirit and generosity of a female. A young woman, who was likewise in the field, took hold of a cord which I had thrown out, and, calling to the men, they yielded that assistance to her request which they had refused to mine. A crowd of people from the neighbourhood soon assembled, who very obligingly assisted me to disembark. General Smith was the first gentleman who overtook me. I am much indebted to his politeness; he kindly assisted in securing the balloon, having followed me on horseback from London, as did several other gentlemen, amongst whom were Mr. Crane, Captain Connor, and Mr. Wright. The inflammable air was let out by an incision, and produced a most offensive stench, which is said to have affected the atmosphere of the neighbourhood. The apparatus was committed to the care of Mr. Hollingsworth, who obligingly offered his service. I then proceeded with General Smith, and several other gentlemen, to the Bull Inn at Ware. On my arrival I had the honour to be introduced to William Baker, Esq., Member for Hertford in the last parliament. This gentleman conducted me to his seat at Bayfordbury, and entertained me with a kind of hospitality and politeness which I shall ever remember with gratitude, and which has impressed on my mind a proper idea of that frank liberality and sincere beneficence which are the characteristics of English gentlemen.

The general course of the second part of my voyage, by which I was led into Hertfordshire, was three points to the eastward of the north from the Artillery Ground, and about four points to the eastward of the north from the place where I first descended.

This is the general account of my excursion. I shall take a few days to recover my strength, and whatever particulars occur to me I shall send you.

VINCENT LUNARDI.

## LETTER VI.

MY DEAR FRIEND,

I should at this time have as much difficulty in describing the effect of my success on the whole English nation as I had in conveying to you an idea of the apprehension and distress I felt lest any untoward circumstances should prevent or defeat my undertaking.

The interest which the spectators took in my voyage was so great that the things I threw down were divided and preserved, as our people would relics of the most celebrated saints. And a gentlewoman, mistaking the oar for my person, was so affected with my supposed destruction that she died in a few days. This circumstance being mentioned on Saturday, when I had the honour of dining with the Judges, Lord Mayor, Recorder, and Sheriffs of London, I was very politely requested by one of the Judges not to be concerned at the involuntary loss I had occasioned; that I had certainly saved the life of a young man who might possibly be reformed, and be to the public a compensation for the death of the lady; for the jury was deliberating on the fate of a criminal whom, after the utmost allowance for some favourable circumstances, they must have condemned, when the balloon appeared, and a general inattention and confusion ensued. The jury was perplexed with considerations on the case, which their curiosity would not suffer them to weigh; and being under a necessity to determine before they departed, they took the favourable side, and acquitted the criminal immediately, on which the court was adjourned to indulge itself in observing so novel a spectacle.

I mention these things, as they may prepare you for the reception I was honoured with on my return to London. No voyager from the most interesting and extensive discoveries, no conqueror from the most important victories was ever inquired for with more solicitude, or welcomed with greater joy. The house of Prince Caramanico had been besieged by multitudes, early and late, to have some account of my safety, or to applaud my return.

You may suppose when I came to town I hastened to Caramanico, who received me with every mark of affection and condescending friendship.

Here circumstances of gratulation and joy crowded on me every hour. I was flattered by learning that while I hovered over London His Majesty was in conference with his principal Ministers. On being informed that I was passing, the King said, "We may resume our deliberations on the subject before us at pleasure; but we may never see poor Lunardi again." The conference broke up, and His Majesty, attended by Mr. Pitt and other great officers of state, viewed me through telescopes while I remained in their horizon.

I had received insults which I thought cruel by persons whose houses overlooked the ground, who erected scaffolds and let out their rooms, so as to deprive me of a chance of having my expenses defrayed. I was no sooner returned but some of these people hastened to atone for their misapprehensions of me. They had considered and treated me as an impostor. My ascension, as a charm, dissipated their ill opinion, and gave them an enthusiasm

in my favour. I am offered the houses and scaffoldings for my own use, if I choose to exhibit again. These things show the importance of success in all undertakings which are not thoroughly understood by the multitude. I am introduced not only into private families, but into public institutions, with the most advantageous and flattering distinctions. The civilities of the Lord Mayor, the Judges, and other magistrates, led me into the Courts of Law; and, though I had made them objects of curiosity, I had never attended trials in circumstances so favourable to information. Every precaution which the wisdom of man can devise seems to be taken here to administer equal justice between all contending parties. The judges are appointed by the king, but rendered independent by an ample provision for their support, and by the tenure of their places, which is during good behaviour, and a proper discharge of their duty. But the peculiar happiness of English jurisprudence is the appointment of juries from the neighbourhood of every offender to adjudge his particular case. The hint is taken from the appointment of judges in the courts of the Prætors in the Roman republic; but those judges were chosen wholly from the citizens of Rome. In England every dispute is decided by the inhabitants of the neighbourhood, who are obliged to attend the parties to the assizes, because they alone are capable of determining the nature of their actions, from a knowledge of their circumstances and characters. It is extraordinary that Rome, who gave the first hints of this admirable mode of trial, should be insensible to its advantages, and perhaps ignorant of its existence.

My fame has not been sparingly diffused by the newspapers, which in England are the barometers of public opinion; often erroneous, as other instruments are, in their particular informations, but yielding the best that can be obtained. You will imagine the importance of these vehicles of knowledge, when you learn that in London alone there are printed no less than a hundred and sixty thousand papers weekly, which, by a stamp on each paper, and a duty on advertisements, bring into the treasury of the nation upwards of eighty thousand pounds a year. They are to the English constitution what the censors were to that of ancient Rome. Ministers of State are checked and kept in awe by them; and they freely, and often judiciously, expose the pretensions of those who would harass government, merely to be taken into its service. But the principal reason of their extensive circulation is the information and entertainment they afford an opulent people, who have leisure and inclination to interest themselves in all public occurrences. On this account the conductors of newspapers seize every opportunity of conveying the earliest information of all the events that take place in the kingdom; and though they must be often mistaken, yet the dexterity with which they trace all sources of intelligence is such that they are generally right.

I have reason to thank the managers of all the papers for their candour and partiality to me. I send you an account from one of them, written and published within a few hours after my descent, founded only on immediate observation and conjecture. You will thereby form your opinion of the attention and industry employed in these prints on all similar, and indeed on all interesting occasions, and you may amuse yourself by comparing their conjectures with facts.

"FROM 'THE MORNING POST,' THURSDAY, SEPTEMBER 16TH, 1784.—LUNARDI'S AERIAL EXCURSION.

"To combat the prejudices of a nation, and the incredulity of mankind, especially when deterred by examples of resentment in consequence of deception or misfortune, when awed by the danger incurred in experiment and the uncertainty of success in the project, must certainly require the greatest effort of human resolution. Whilst we are recollecting the occasion, which collected one-tenth of the inhabitants of the metropolis within the optical powers of an individual, we cannot help indulging ourselves in these eccentric reflections. The aërial voyage, which has long been proposed by Mr. Lunardi, was appointed for yesterday, and perhaps the English nation never witnessed upon any occasion whatever such a number of persons collected together and so *loftily* displayed as were to be seen in the environs of Moorfields; not a plain or an eminence, a window or a roof, a chimney or a steeple, within the view of Bedlam, but were prodigiously thronged. About half-past one o'clock the Prince of Wales arrived in the Artillery Ground, and after receiving the salutations of the gentlemen of the Artillery, though not *à la militaire* but *en obeïssance cap-à-pié*, his Royal Highness having expressed a wish to dispense with military attentions, he viewed the apparatus of the balloon and retired to the Armoury House, which was occupied by persons who had liberally paid the adventurer for their admission. We were sorry indeed to observe that such general advantages had been taken by the neighbourhood of farming their windows, and for benefits which were due only to the novelty and spirit of the enterprise. About a quarter before two o'clock the balloon was sufficiently filled and closed, and the gallery and other apparatus prepared to be suspended; but on Mr. Lunardi and

his intended companion, whom we understand to be Mr. Biggin, a young gentleman of fortune and enterprise, having taken their situations, and finding that the machine was unequal to their weight, it was determined that Mr. Lunardi should ascend alone. A cannon having been fired as a preparatory signal, Mr. Lunardi, having embraced his friends, and all matters being adjusted, a second cannon was fired as the signal of ascension. Insensible must that heart be which did not feel itself anxious and interested at that moment for the fate of him, who intrepidly stepped into his seat, and, Phaeton-like, seized the reins which were to guide the chariot of the sun. About five minutes after two o'clock the machine was launched; and as if dreading the course it had to run, and unwilling to proceed, after having mounted about twelve yards, it reclined to its native earth; but roused by ambition and the spirit of philosophical researches, Mr. Lunardi rebuked its fear, and gave its swiftness to its airy flight. He took his seat in the gallery with great composure and confidence on the balloon's being launched; but finding himself too equally poised, he readily discharged part of his ballast, which consisted of small bags of white dry sand, and by that means relieved his weight and caused a regular and most beautiful ascension. After he had cleared the buildings, subject to the direction of the easterly wind, he saluted the populace with great elegance and gallantry by waving a blue flag, which he had taken for the purpose, and seemingly bidding them a friendly adieu. The gallery was formed of an upright four feet square, and netted with a strong cord, about breast high, but quite open at the top. After this salutation, for the space of five minutes he dropt his flag with an air of security, and having seated himself, took to his oars; but as we since learn, finding they compressed the wind too much, he disengaged one, which was taken up about Smithfield: at that time his friends were alarmed for the consequence.

Steering at this moment due west, he suddenly tacked towards the north, and with little variations, according to the altitude he obtained, till he seemed by degrees to establish that direction, his progress seemed exceedingly elevated and swift, although the balloon appeared under masterly management. We viewed this object, nevertheless, distinctly for one hour and twenty minutes, with a mixture of anxiety and delight, not unalloyed, however, by a friendly dread for the ultimate effect, until we were this moment relieved by the following intelligence from very good authority, viz., that Mr. Lunardi lowered himself towards the earth near Barnet, but not approving the situation and finding he had the command of his machine, he discharged a part of his ballast and pursued his course until he arrived over Collier's-hill, five miles beyond Ware, in Hertfordshire, at twenty-five minutes past four o'clock; there he alighted, and was received by the neighbourhood with testimonies of admiration.* He afterwards returned to town, where no doubt his friends and every true lover of courage and merit will receive him with friendship and respect. His companions in this adventurous voyage were a dog and cat; the latter was destroyed, and the dog was almost spent by the severity of climates through which they passed. Mr. Lunardi himself was, of course, affected by the change of elements, as may be readily conceived by those who are told that icicles were hanging on his clothes.

Such were the incidents of yesterday, and we heartily wish that the effects may be valuable to the projector. Every Englishman should feel an emulation to reward him; for uncertain as the good to be derived from such an excursion may be thought, yet it becomes the nobleness of our nature to encourage them. Discoveries beyond the reach of human comprehension at present may by perseverance be accomplished. Emulation and industry are a debt which is due to posterity, and he who shrinks from innovation is not his country's friend. Encouragement is the spur to emulation, and emulation the parent frequently of excellence; let Mr. Lunardi, therefore, be rescued by a generous public out of the hands of a villain, who has emphatically been described as being industrious only in matters wherein honest men would be ashamed, but to whom Mr. Lunardi has been a dupe in this undertaking, and injured instead of being benefited by the danger he has encountered."

On the Sunday immediately after my return I had the honour of waiting on Sir James Wright, who had been politely solicitous to give me testimonies of his approbation. He had the goodness to represent to His Majesty

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* The vulgar and the great
Equally happy now, with freedom share
The common joy. The shepherd-boy forgets
His bleating care; the labouring hind lets fall
His grain unsown; in transport lost, he robs
Th' expecting furrow, and in wild amaze
The gazing village point their eyes to heaven.

that I wished to lay an account of my voyage at His Majesty's feet, who appointed Friday for my attendance at St. James's.

On Wednesday Sir James Wright took me to court. The drawing-room was very crowded, it being the anniversary of the King's Coronation. I was surrounded with the ministers of state and the nobility, when the Prince of Wales entered the drawing-room. My person was pointed out to him by one of the Secretaries of State, on which he said in the lively and familiar manner which is peculiar to him, "O Mr. Lunardi, I am very glad to see you alive." As a proof of the attention of this amiable Prince, I must let you know he did me the honour to send his Equerry to say he observed at my ascension I had not a watch describing seconds of time, as I was under a necessity of borrowing one from Mr. Aubert, who has since honoured me with his friendly attention, and that his Royal Highness had ordered his watchmaker to take my directions for such a one as might be useful to me another time. On mentioning this circumstance to Prince Caramanico, he immediately said I might want such a watch before that which was ordered by the Prince of Wales could be ready, and taking out his own, presented it to me in the kindest manner imaginable.

The rumour that I had sunk a considerable sum of money by the adventure was soon circulated, and subscriptions have been opened in several parts of London for my advantage; but with what effect I must not yet presume to judge.

But you will wonder, perhaps, that I should think it necessary on this occasion to become an author. Spurious accounts and misrepresentations of my excursion, have been published by booksellers of some consideration here. They have been reprehended freely and perhaps severely by my publisher, who is very warm and zealous for my interest, and who suggested to me the plan of revising and publishing my letters to you, as necessary to the reputation of my undertaking, and likely to be conducive to my advantage. He is a man of spirit and judgment in his profession, whose name is already familiar to you and all the world by his complete and beautiful edition of the English poets. I have yielded to his advice, and entertain the fullest confidence that under his direction my enterprise will not be dishonoured. He is now soliciting the attention of the public towards a new edition of Shakspeare's works, which, by the elegance of the specimen he has produced, promises to render an author, whose genius is here deemed only short of inspiration, celebrated in all parts of the world, not exempting those where his native language is not understood. Permit me, as a mark of gratitude, to recommend that work, in its infant state, to your protection and encouragement. I have taken the liberty of entering your name as a subscriber, and hope soon to have the pleasure of adding many more by your means.

Most of my time is now taken up with the exhibition of the balloon, and indeed of myself; for the principal curiosity is to see me, at the Pantheon, which is one of the largest and most splendid rooms in Europe. It is difficult to imagine anything more pleasing than the solicitude which multitudes of beautiful women express concerning dangers that are past, and the heroism of others who wish to accompany me in my second tour. I receive the compliments and congratulations of two or three thousand persons in a day. You must not wonder if I conceive an opinion of my own consequence and become vain. I have been made an honorary member of the Artillery Company, in whose uniform I accompanied Sir James Wright this morning, to lay before His Majesty a short account of my excursion.

I was received in the most gracious manner. The King took my account, talked to me about five minutes on the subject of aerostation, permitted the usual honour of kissing his hand, and I took my leave.

I have led you, my dear friend, through my apprehensions, difficulties, and anxieties, to the completion of almost all my wishes respecting the first attempt I made to place myself on the records of fame.

It has been no small assistance to me that I have ever wished not to dishonour your care, advice, and friendship; and it heightens every gratification that I can always subjoin

I am your sincere and affectionate friend,

VINCENT LUNARDI.

Having wrote several letters, while on my excursion in the atmosphere, I had several inducements to employ myself in that manner. It proved the astonishing evenness and smoothness of the motion; and, by throwing down any information of myself, there was a chance of its falling into the hands of my friends, and relieving their anxiety concerning my safety, and the state of my spirits and mind.

I threw down several to the same effect with the following, one of which was very obligingly conveyed to

me by —— Carimajor, Esq., who found it, not very far from the milestone on Northaw Common, while out a shooting. I have collated my own copies, written with a pencil; and the following letter is inserted, as an additional proof of the felicity with which I performed the whole voyage:—

*Addressed to any Person or Persons who may pick up this Letter.*

My dear Friend or Friends,

The anxiety which my acquaintance showed at my departure makes it necessary to assure them that my situation is, at this moment, the happiest of my life. The relief of my mind, and the accomplishment of my purpose, which I now see is practicable in all respects, concur with the temperature of the air and the magnificence of prospect to sooth and gratify my mind with the highest delight. The thermometer is at 50°, and I will keep myself in this station till three o'clock; I shall then ascend higher, to try the effect of a different aërial climate, as well as to put my oar to a fair trial.

I beg the person or persons who may take up this letter to take notice of the time and place, and to convey either the letter or the contents of it to my kind friend and patron, Prince Caramanico, No. 56, in New Bond-street, to Sir Joseph Banks, Soho-square, or to Doctor Fordyce, Essex-street, to whom I have many and great obligations, and who may have the goodness to be concerned, if they should soon learn I am cheerful and well.

I am particularly anxious that the earliest information of me should be given to George Biggin, Esq., Essex-street, the loss of whose company is the only abatement of my present joy; but I hope for that pleasure another time.

My desire to convey some news of me is from an opinion that my descent may not be effected immediately, or within the distance of forty or fifty miles. In that case I might not be able to convey them any letter or message in time to save them uneasiness on my account. It is now exactly three o'clock, the air has a mildness and sweetness I never experienced, and the view before me is heavenly. Happy England! I see reasons to hail thy peculiar felicity!

Farewell,

Vincent Lunardi.

To VINCENT LUNARDI, Esq.

Sir, Bayford, near Hertford, September 18, 1784.

I send you this by my servant, that I may learn from yourself what I am extremely anxious to hear, that your health has not suffered by your late fatigues, that your balloon arrived in London without injury, and at the same time to acquaint you with the further steps I have taken in your business.

Yesterday morning I made to the very spot where your balloon in its passage touched the ground, and where your cat was landed; and with the assistance of several people who were witnesses, particularly of a person whom you may recollect to have been near the balloon at the time on horseback, and of the very girl who picked up the cat, have ascertained the place with a sufficient precision. They pointed out the part also where your grapple dragged, and mentioned some other circumstances, the most of which I propose to collect into a formal deposition, and shall attend them again to-day to obtain their more solemn confirmation of the facts.

Yesterday, at my request, five of the harvest-men, mentioned in the deposition of Elizabeth Brett (which you have with you) attended me here, and have in the same formal mode deposed to the time, manner, and place of your last descent, and to the fact of their coming to the assistance of Elizabeth Brett, as stated by her. This deposition shall accompany the other, which I am to take to-day, and you will make such use of them as you may find necessary. I cannot, however, avoid saying that admiration and astonishment seem so thoroughly to have taken possession of all ranks of people instead of that incredulity which your friend, Mr. Sheldon, apprehended, that these supplemental proofs are hardly required. If finally they should, however, be thought requisite, it will give me particular pleasure in having procured them. Whatever you may be advised by your friends in London to give to the public will, I have no doubt, be well considered: it cannot be detailed in terms too plain and simple. You must be sensible that the *façons de parler* here and in France are extremely different, and that truth has never received advantage from unnecessary ornament. You will recollect, too, that the account will be read by thousands, who were not witnesses of the facts. You will make such use of the subjoined memorandum as you think necessary.

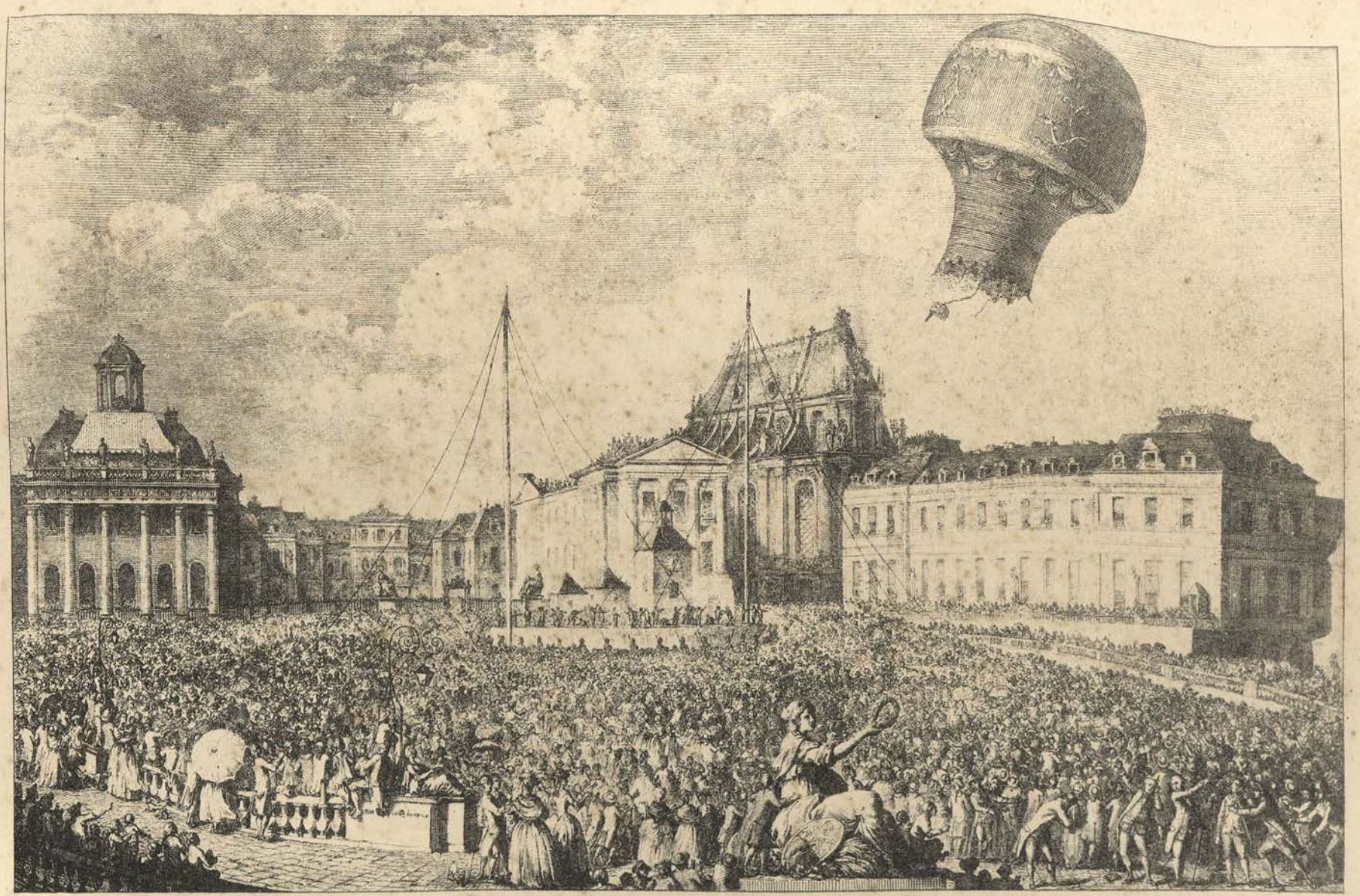

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Holsham Jones R.E. Col.Sir H.James R.E. F.R.S.&c.Director.*

1864

Your general course from the spot of your departure, in the Artillery Ground, to that of your first descent, was something more than one point on the compass to the westward of the north, and the general course of your second voyage was three points on the compass to the eastward of the north from the place of your first departure, or something more than four points on the compass to the eastward of the north from the place of your first descent: observe, I speak of your *general* course, with a reference to the best maps which I have by me. What deviations or traverses you might make from time to time in both voyages, as you certainly must have made many, you will best judge. As a proof of this, you will recollect that the field in which the last letter with the belt annexed was found, lies about one mile and a half to the eastward, being a point to the south of the spot where you finally landed; if, therefore, the belt and letter dropped in anything like a perpendicular direction, the course you took after the dropping of this letter must have been west, with a point to the north. I mention this by the by for your consideration.

With respect to the identical spots on which you made the two descents, you may wish to know the literal fact.

That where you made your first descent, that is, where your gallery came to the ground, and where or near to which you put out the cat, is a large ploughed field belonging to John Hunter, Esq., of Gubbins, in the county of Hertford. The field itself is part of the lately enclosed common of North Mimms, in the manor of the Duke of Leeds. The field is about half a mile to the eastward of the sixteen-mile stone, on the road leading from London to Hatfield, and adjoining to the road leading from the said turnpike-road to the northward on the left. The particular spot in the field is on the east side, very near to the boundary-line between the manors of Northaw and North Mimms. For the present a common hedgestake only marks the spot; but with your leave and the permission of Mr. Hunter I propose to erect a stone there, with a suitable inscription to record the fact, as I shall likewise do on the spot of your last descent, if, as I have no doubt, I can obtain permission of the proprietor. It is remarkable that the field where you made your first descent is called *Italy*, from the circumstance which attended the late enclosure of a large quantity of roots, rubbish, &c., having been collected there, and having continued burning for many days. The common people having heard of a burning mountain in Italy, gave the field that name. You hardly conceived, when you dropped, that you was so near to anything that had connexion with Naples.

The place of your final descent is imperfectly described in Elizabeth Brett's deposition, but is in fact, as there stated, in the parish of Standon, about half a mile to the northward of the twenty-four mile stone, on the road that leads from London to Cambridge, through Ware and Puckeridge.

If you wish to have any further conversation with me on these matters, I can come to London conveniently after Wednesday next, and will attend you with pleasure, if you give me notice.

The enclosed scraps of paper were found in the field where you first descended, near the part where your grapple took up the corn. Whether you threw them from the balloon you will recollect.

I have no tidings of the two first letters; probably to-day I may hear something of them, as I shall meet many persons assembled from different parts of the country.

Adieu. Most sincerely yours,

W. Baker.

## DEPOSITIONS.

*The voluntary Declaration and Deposition on Oath of* Nathaniel Whitbread, *of Swanley Bar, Farmer, in the Parish of North Mimms, in the County of Hertford, Yeoman.*

This deponent, on his oath, saith, that being on Wednesday the 15th day of September instant, between the hours of three and four in the afternoon, in a certain field called Etna, in the parish of North Mimms aforesaid, he perceived a large machine sailing in the air near the place where he was on horseback; that the machine continuing to approach the earth, the part of it in which this deponent perceived a gentleman standing came to the ground, and dragged a short way on the ground in a slanting direction; that the time when the machine thus touched the earth was, as near as this deponent could judge, about a quarter before four in the afternoon. That this deponent being on horseback, and his horse restive, he could not approach nearer to the machine than about four poles; but that he could plainly perceive therein a gentleman dressed in light-coloured clothes, holding in his hand a trumpet, which had the appearance of silver or bright tin. That by this time several harvest-men coming up from the other part of the field, to the number of twelve men and thirteen women, this deponent called to them to endeavour to stop the machine, which the men attempted; but the gentleman in the machine desiring

them to desist, and the machine moving with considerable rapidity, and clearing the earth, went off in a north direction, and continued in sight at a very great height for near an hour afterwards. And this deponent further saith, that the part of the machine in which the gentleman stood did not actually touch the ground for more than half a minute, during which time the gentleman threw out a parcel of what appeared to this deponent as dry sand. That, after the machine had ascended again from the earth, this deponent perceived a grapple with four hooks, which hung from the bottom of the machine, dragging along the ground, which carried up with it into the air a small parcel of loose oats, which the women were raking in the field. And this deponent further, on his oath, saith, that when the machine had risen clear from the ground about twenty yards, the gentleman spoke to this deponent and the rest of the people with his trumpet, wishing them good-by, and saying that he should soon go out of sight. And this deponent further, on his oath saith, that the machine in which the gentleman came down to the earth appeared to consist of two distinct parts, connected together by ropes: namely, that in which the gentleman appeared to be, a stage boarded at the bottom and covered with netting and ropes on the sides, about four feet and a half high; and the other part of the machine appeared in the shape of an urn, about thirty feet high, and of the same diameter, made of canvas, like oilskin, with green, red, and yellow stripes.

NATHANIEL WHITBREAD.

Sworn before me, this 20th day of September, 1784, WILLIAM BAKER.

*The voluntary Declaration and Depositions on Oath of* WILLIAM HARPER, *of the Parish of Hatfield, in the County of Hertford, Labourer, and of* MARY BUTTERFIELD, *of the Parish of North Mimms, in the County of Hertford, Spinster.*

This deponent, William Harper, on his oath saith, that as he was mowing oats in a certain field called Etna, in the parish of North Mimms, in the county of Hertford, on Wednesday, the 15th of this instant September, between three and four o'clock in the afternoon, in company with Thomas Blackwell, Thomas Moore, John Richardson, and several others, he perceived a large machine hovering in the air and gradually approaching the ground near the boundary-line of the manors of Northaw and North Mimms; that on his approaching the machine, in company of the persons aforementioned, the machine, which had then passed the said boundary-line, touched the earth in the said field called Etna. And this deponent, being then at the distance of four or five poles from the same, plainly perceived a gentleman in the lower part of the said machine, dressed in light-coloured clothes and a cocked hat, who, on the machine touching the ground, threw out a parcel of dust or white sand; that immediately the machine mounted again into the air, and went off in a north direction; that while the machine continued touching the ground, Mr. Nathaniel Whitbread, who was likewise present on horseback, desired this deponent and the rest who were present to stop the said machine, which some of them, and in particular Thomas Blackwell, attempted to do; but the gentleman desiring them not to stop the machine, they desisted. And this deponent, Mary Butterfield, on her oath saith, that she was raking oats in the said field called Etna, on Wednesday the 15th of September instant, between three and four o'clock in the afternoon, in company with Mary Crawley, Sarah Day, and others, and perceived a large machine hovering over Northaw Common, and approaching the earth in the field where this deponent was at work, which at length it touched in the said field called Etna; and during the time that it so touched the ground a kitten, which was in the lower part of the said machine, came out on the field, which this deponent picked up, and soon afterwards sold to a gentleman who came up to the hedge-side, inquiring after the machine, which he called an air-balloon. That this deponent plainly perceived a gentleman in the lower part of the machine, dressed in light-coloured clothes, who, on the machine ascending again, spoke through his trumpet, and wished them good-by. And these deponents, William Harper and Mary Butterfield, severally, on their oaths, say that the machine which came down to the earth appeared to consist of two parts connected together: namely, that in which the gentleman was appeared to be a framework of wood and netting, from which there stuck out a sort of wing; and the other part of the machine appeared in the shape of a large pear with the stalk downwards, and appeared to be made of silk or canvas, in stripes of green and red. And this deponent, Mary Butterfield, further, on her oath, saith, that when the machine was ascending from the ground, she, this deponent, perceived an anchor or grapple drag along the ground, which took with it a small parcel of the oats from the field where they were raking.

his
WILLIAM ⋈ HARPER.
mark.

her
MARY ⋈ BUTTERFIELD.
mark.

Sworn before me this 20th day of September, 1784.

*The voluntary Declaration and Deposition on Oath of* ELIZABETH BRETT, *Spinster, Servant to* Mr. THOMAS READ, *Farmer, in the Parish of Standon, in the County of Herts.*

This deponent, on her oath, saith, that on Wednesday the 15th day of September instant, between four and five o'clock in the afternoon, she, this deponent, being then at work in her master's brewhouse, heard an uncommon and loud noise, which, on attending to it, she conceived to be the sound of men singing as they returned from harvest-home. That upon going to the door of the house she perceived a strange large body in the air, and, on approaching it in a meadow-field near the house, called Long Mead, she perceived a man in it; that the person in the machine, which she knew not what to make of, but which the person in it called an air-balloon, called to her to take hold of the rope, which she did accordingly; that John Mills and George Phillips, labourers with said Mr. Thomas Read, came up soon after, and, being likewise requested to assist in holding the rope, both made their excuses, one of them, George Phillips, saying he was too short, and John Mills saying that he did not like it; that this deponent continued to hold the rope till some other harvest-men of Mr. Benjamin Robinson, of High Cross, came up, by whose assistance the machine was held down till the person got out of the machine. And this deponent further, on her oath, saith, that the person now present and shown to her by William Baker, Esq., the justice of peace before whom this deposition is taken, as Mr. Vincent Lunardi, and in her presence declares himself to be Mr. Vincent Lunardi, was the person who called to me from the machine, as above stated, and who descended therefrom in the said field called Long Meadow.

her
ELIZABETH ⋈ BRETT.
mark.

Sworn before me this 16th day of September, 1784, at Bayford Bury, in the county of Hertford, aforesaid.

*The voluntary Declaration and Depositions on Oath of* JONAS LANGTON, JOHN CHIVEN, JAMES CRAMPLAN, EDWARD BENTLEY, WILLIAM WALLER, *severally made this 17th day of September*, 1784, *before* WILLIAM BAKER, Esq., *one of His Majesty's Justices of the Peace for the County of Hertford.*

The said deponents, on their oath, severally declare, that on the 15th of this instant, September, between four and five o'clock in the afternoon, being then at work, some of them in the harvest-fields and others in the farmyard of Messrs. Benjamin Robinson and James Snow, in the parish of Standon, in the county of Hertford, they saw a large and uncommon machine hovering in the air, which they severally followed till it arrived at a certain mead, called Long Mead, in the occupation of Thomas Read, yeoman, of Standon aforesaid, where the same touched the ground; and on their severally arriving at the same place they found Elizabeth Brett, spinster, maid-servant with Thomas Read aforesaid, holding a rope which was fixed to the said machine; that on their severally approaching the said machine they perceived a gentleman in one part of it, who desired them to assist Elizabeth Brett, the servant, who was then holding the rope, which they did accordingly; that by this assistance the machine being stopped, the gentleman who was in it came out, and to these deponents declared that he had set out from the Artillery Ground in London, a little before two o'clock in the afternoon of the said day, in the machine, and had travelled through the air to the place where they found him.

Sworn before me this 17th day of September, 1784, at Bayford Bury, in the county of Hertford.

A gentleman well known in the literary world having sent Mr. Lunardi the following epistle as a compliment to his genius and enterprising spirit, Mr. Lunardi's friends have strongly expressed their wishes to have it annexed to these letters, and the author has obligingly given permission to have it printed with them.

## AN EPISTLE TO SIG. VINCENZO LUNARDI.

Excuse it, bold Youth, if a stranger should dare
To address thus *Your Highness* as KING of the *Air*,
For I was a witness, a charmed one, I own,
When you sprung to the skies, and ascended your throne
Amid two hundred thousand good people assembled,
Who felt for your fame, for your safety too trembled;
Whilst you, a true HERO, of nothing afraid
Took leave of the world, and mankind, undismay'd;

Determin'd to bid every danger defiance
For the noblest of conquests, the conquest of SCIENCE.

When you bid us adieu, and first quitted the earth,
To what varied sentiments gave you quick birth?
Each mind was brim full of unnumber'd strange notions,
Each eye all attention, to watch all your motions.
The multitude scarcely believ'd that a man
With his senses about him could form such a plan,
And thought that as BEDLAM was so very nigh
You had better been there, than turned loose in the sky!
But when they perceiv'd you rose higher and higher,
O'ertop'd every building, each church, and each spire,
They extoll'd with one voice your superlative merit,
Who could hazard your life with so dauntless a spirit,
With benevolent wishes each bosom now burns,
And *Awe* and *Amazement* both fill it by turns.—
" Where's he going?" cries one,—" Why he shrinks from our sight!
" And where's this poor fellow to quarter to-night?
" If he soars at this rate in his silken balloon,
" He'll surely by Sunset be up with the Moon!"
Whilst "God save his *Soul*," was the prayer of most,
As they took it for granted your *Body* was lost—
The lovers of science who best of all knew
How much might be hop'd from a Genius like you,
In silence pursu'd you, unwilling to speak,
For the tear of anxiety stole down their cheek.—
In their own way of thinking, all felt, and all reason'd,
Greedy ALDERMEN judg'd that your flight was ill season'd,
That you'd better have taken a *good dinner* first,
Nor have pinch'd your poor stomach by hunger, or thirst.
In perfect indiff'rence the BEAU yawn'd a blessing,
And fear'd before night that your hair would want dressing:
But the LADIES, all zeal, sent their wishes in air,
For a man of such spirit is ever their care!
ATTORNEYS were puzzled how now they could sue you,
UNDERWRITERS what premium they'd now take to *Do you*,
Whilst the sallow-faced JEW of *his Moneys* so fond
Thank'd Moses, he never had *taken your Bond*.

Amid these sensations which mov'd us below
Through the realms of pure Ether triumphant you go,
A course which no mortal had here before dar'd;
For YOU, was the risk, and the glory prepar'd;
Though depriv'd of that FRIEND who had urg'd the fond claim
To partake all your dangers, and share in your fame,
From all human aid though cut off, and alone,
When mounting thus singly, you still greater shone!—

Ah! tell me LUNARDI,—hereafter you may!
What new scenes of wonder your flight must display?
How awful the feel, when through new regions gliding,
Through currents untried, and from cloud to cloud sliding?
With what new ideas your mind must o'erflow!
With what new sensations your bosom must glow!—
How little, how trifling, must then in your eyes
Have seem'd what *below* we look up to, and prize!
No more than a molehill, the TOWER's old walls,
A Hop-pole the MONUMENT,—Bandbox, ST. PAUL's.

The vast host of people you quitted so lately,
Which spread to each present a scene the most stately,
To one who so distant on all of us gazes
Must look like a meadow embroider'd with daisies;
Nay, e'en this GREAT CITY we all hold so dear
As a HONEY-COMB only to you would appear,
All its SHIPPING mere spots, though its bulwark and pride,
The BANK and the TREASURY hardly descried,
The abodes of the Great not discern'd e'en with winking,
And the THAMES but a basin for lap-dogs to drink in.—
'Tis the points whence we view things which fix, or create
Our imperfect conceptions of Little, or Great!

An adventurous stripling, so sweet OVID sings,
Had the boldness to soar once on two mighty wings,
Unguided by judgment, and wand'ring too high,
He met his just fate, and was plung'd from the sky,
And all that the world from this tale have been able
To learn, was, it gave false Ambition a fable.—
But from flights such as yours we've reason to hope
Philosophy one day may gain wider scope,
The secrets of nature are slowly reveal'd,
Though much is discover'd, far more is concealed.
A spirit like yours can assist best the cause
And more clearly illustrate her motions and laws;
But should not to you the great lot be assigned
To establish new doctrines of air or of wind,
Should future Adventurers still further rove,
And pursuing your course, your discov'ries improve,
Yet know, GALLANT YOUTH, that to none but to YOU
Will in ENGLAND the praise, and the triumph be due,
In the FIRST bold attempt so intrepid who shone,
And show'd by *Example* how much could be done.
Our country will gratefully boast of your name,
And LUNARDI be plac'd on the bright scroll of fame,
With the warmest acclaims of the PUBLIC applauded,
By PHILOSOPHERS lov'd—By the MUSE too recorded!—

Amidst all these honours, a stranger who fir'd
By what he beheld, what yourself have inspir'd,
Round your temples while this little tribute he wreaths,
Thus with zeal his fond wishes prophetic he breathes,
Long enjoy Th' AERIAL THRONE you now sit on!
And live, ah! long live,—The COLUMBUS of BRITAIN!

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We again take up the Cavallo narrative of these early experiments; he says, that,

On the 19th of September, at Paris, the balloon was filled, in three hours' time, by M. Vallett; the two MM. Roberts and M. Collin Hullin entered into the boat, and, with the addition of four hundred and fifty pounds of ballast, they were perfectly balanced. At noon they threw out twenty-four pounds of ballast, in consequence of which they began to rise very gently. At that time the mercury in the barometer, on the level of the sea, stood at 29·6 inches, and the thermometer stood a little above 77°. Soon after, they threw out eight pounds of ballast, in order to avoid going against some trees; in consequence of which they rose to 1400 feet. At this elevation, perceiving some stormy clouds near the horizon, they went up and down, endeavouring to find some

current of air which might carry them out of the way of the storm; but from 600 feet height to 4200 the current of air was quite uniform. Having lost one of the oars, they suppressed another on the opposite side of the boat, and by working with the remaining three found that they accelerated their course. "We travelled," says their account, "at the rate of twenty-four feet per second, and the manœuvring of the oars helped us about a third." At forty minutes past three o'clock they heard a thunderclap, and three minutes after they heard another, much louder; at this time the thermometer from 77° came down to 59°. This sudden cold, occasioned by the approach of the stormy clouds, condensed the inflammable air and made the balloon descend very low; hence they were obliged to throw out forty pounds of ballast. They had the curiosity to examine the degree of heat within the balloon, and, introducing a thermometer into one of the appendices, the quicksilver rose immediately to 104°, whereas the external thermometer stood at about 63°. The barometer stood at 23·94 inches. In this region of the atmosphere they were so becalmed that the machine did not go even two feet a minute; and, availing themselves of that opportunity to try the power of their oars, they worked them for about thirty-five minutes, and, by observing the shadow of the machine on the ground, they found that they had described an elliptical track, the smallest diameter of which was about 6000 feet.

The rest of this voyage being very interesting is best described in their own words:—"We perceived below us some clouds that ran very rapidly from south to north. We descended to the level of those clouds, in order to follow that current, the direction of which was changed since our departure. The close of daylight being near, we determined to follow that current for forty minutes only; increasing our velocity by the use of our oars, we endeavoured to deviate from the direction of the current, but we could not obtain a deviation greater than 22 degrees towards the east. The length of our route, during about one hour and a quarter, was 2100 feet. Willing to try whether the wind nearer the earth was strong, we descended to the height of three hundred feet, where we met an exceedingly rapid current. At some distance from Arras we perceived a wood, over which we did not hesitate to pass, though there was hardly any daylight upon the earth; and in twenty minutes' time we came near Arras, on the plain of Beuvry, distant nearly three-quarters of a mile from Béthune, in Artois. As we could not distinguish amongst the shadows the body of an old mill, upon which we were going to descend, we avoided it by the help of our oars, and descended amidst a numerous assembly of inhabitants."

When they descended, which was at forty minutes past six o'clock, there were above two hundred pounds' weight of ballast still remaining in the boat. The way they had travelled was about fifty leagues, or one hundred and fifty miles. The account of this voyage is concluded with the following remarks:—"Those experiments show that, far from going against the wind, as is said by some persons to be possible, in a certain manner, and some aeronauts pretend to have actually done it, we have only obtained, by means of two oars, a deviation of 22°. It is, however, certain that, if we could have used our four oars, we might have deviated about 40° from the direction of the wind; and as our machine would have been capable of carrying seven persons, it would have been easy for five persons to have gone, and to have put in action eight oars, by which means a deviation of about 80° might have been obtained.

"We have already observed, that if we did not deviate more than 22°, it was because the wind carried us at the rate of twenty-four miles an hour. And it is natural to judge, that if the wind had been twice as strong as it was, we should not have deviated more than half what we actually did; and, on the contrary, if the wind had been only half as strong, our deviation would have been proportionably greater."

*Aerostatic Experiments made in the remainder of the Year* 1784.—The second aerial voyage made in England was performed by M. Blanchard, and Mr. Sheldon, Professor of Anatomy to the Royal Academy, who is therefore the first Englishman that ascended with an aerostatic machine. This experiment was performed at Little Chelsea, about two miles distant from London, on the 16th of October.

We have already shown by the mention of Mr. Tytler, that our narrator's information on this point is not correct. Mr. Monck Mason, also, in his careful researches in 1836, discovered that Mr. Sadler had ascended from Oxford, on the 12th of October in this year.

At nine minutes past twelve o'clock the balloon ascended, but, after a few feet elevation, it returned again to the ground; it hit likewise against an adjoining wall, and, in short, the boat was loaded with too much weight.

This obliged the two gentlemen to throw out several things that were of no immediate use; in consequence of which the machine at last rose with great velocity almost perpendicularly, and took a course nearly south-west. The weather being hazy, it went soon out of sight; but as long as it remained in view it appeared to go in one invariable direction. The balloon, unable to sustain long the weight of two persons, began to descend after having been up about half an hour. As the barometer was out of order, in consequence of an accidental blow, M. Blanchard used an ingenious and at the same time easy method of observing whether the balloon was ascending or descending. It was merely to put a ribbon out of the boat, which, being impelled upwards by the air, showed that they were descending. Small downy feathers might answer this purpose still better. The throwing down a bottle prolonged their descent; but at last the machine alighted in a meadow near the village of Sunbury, in Middlesex, which is about fourteen miles distant from London; it being then fifty minutes past twelve o'clock. There Mr. Sheldon came out of the boat; and M. Blanchard, after taking a quantity of ballast nearly equivalent to the weight of Mr. Sheldon, which employed near thirty minutes, reascended alone and continued the voyage.

In this second ascension M. Blanchard's account says that he was carried at first by a north-east current, and soon after, meeting with another current, he was carried east-south-east of Sunbury; but finding the balloon too much distended, he opened the valve at the top of it, and descended again into the north-east current, it being then just twenty-six minutes past one. Four minutes after he entered into a thick fog, in which he remained five minutes. This fog occasioned the balloon to contract considerably. At thirty-eight minutes past one, the heat of the sun became excessive, in consequence of which the globe was again distended. In the course of this voyage M. Blanchard says that he went so high as to experience great difficulty in breathing. He likewise relates a curious circumstance, which is, that a pigeon which had been taken in the boat, being affrighted by the bursting of a bladder full of air, flew away, labouring very hard with its wings in order to sustain itself in the rarefied air of that elevated region of the atmosphere. The poor animal wandered about for a good while, but at last, finding no other place to stand upon, returned to the boat and rested on one side of it.

At fifty-eight minutes past one, the cold being intolerable, M. Blanchard descended a considerable deal lower, so as to distinguish men and hear their noise on the earth. Some time after he again ascended higher, then was becalmed for a short time; and thus, after several such-like vicissitudes, he came in sight of the sea, the approach to which at last determined him to put an end to the voyage; and accordingly he descended, at half-an-hour after four, in a plain which lay in the vicinity of Romsey in Hampshire, about seventy-five miles distant from London.

It was related in the newspapers that at Oxford, on the 4th of October, one Mr. Sadler ascended with a rarefied-air balloon; but, after strict inquiry, it was found that nobody saw him either ascend or descend. However, on the 12th of the following month he really ascended, with an inflammable-air balloon, from the Physic Garden at Oxford, in the presence of surprising numbers of people of all ranks. The balloon being sufficiently filled by a little before one o'clock, Mr. Sadler placed himself in the boat, which was fastened by ropes to the net that went over the balloon. Then the machine, being abandoned to the air, ascended with such velocity that in three minutes' time it was hid in the clouds, but a few moments after became visible again; and thus it appeared and disappeared three or four times, seeming always to ascend, and at the same time moving with great rapidity in the direction of the wind, which blew rather hard from the south-west. In this voyage Mr. Sadler crossed Otmoor, Thame, and other places; but an aperture made in the balloon, almost as soon as it was launched, exhausting the inflammable air very fast, obliged him to throw out successively all his ballast, provisions, instruments, &c., and at last forced him to descend at Hartwell, near Aylesbury, which is about fourteen miles distant from Oxford; which length he travelled in seventeen minutes; so that he went at the rate of near fifty miles an hour. He found himself exceedingly wet in passing through the heavy clouds, and in descending had the misfortune of being entangled in a tree, afterward swept the ground and rebounded to a considerable distance, but at last alighted safe.

It is said that Mr. Sadler was the sole projector, architect, workman, and chemist in this experiment.

On the 30th of November M. Blanchard made his fifth aerial voyage in his old balloon, being his second voyage in London. He was accompanied by Dr. J. Jeffries, a physician, and native of America, and ascended from the Rhedarium, in Park-street, Grosvenor-square, at about two o'clock in the afternoon. M. Blanchard was now furnished with wings or oars, which he worked very fast, but their action seemed to produce no effect on the course of the machine. His direction being about east by south, he passed over London; but the weather being

very hazy, the machine did not show so fine a spectacle as could have been wished. It does not appear that either of the two travellers made any particular philosophical observation, though they were provided with several instruments. They descended, near the Thames, in the parish of Stone, in Kent, at the distance of twenty-one miles from London.

*Aerostatic Experiments made in the beginning of the Year* 1785.—On the 4th of January, 1785, Mr. Harper ascended with an inflammable-air balloon from Birmingham. The weather was very rainy, hazy, and foggy, and the barometer stood at 28·4; the thermometer stood at 40°. At about a quarter before one o'clock he ascended, in presence of an immense multitude of spectators and amidst a very hard rain, which increased to an uncommon degree for six minutes after; but in four minutes more the aerial adventurer got above the clouds and enjoyed the vivifying influence of the sun and a purer air.

At about two o'clock Mr. Harper descended at Millstone Green, near Newcastle, in Staffordshire, about fifty miles distant from Birmingham. In this voyage the thermometer never came lower than 28°, and Mr. Harper experienced no other inconvenience than what might be expected to arise from the changes of wet and cold, except a temporary deafness.

We come now to the account of a voyage which deserves to be long remembered. It is nothing less than the crossing of the English Channel in an aerostatic machine. The same balloon which had carried the enterprising M. Blanchard five times through the air served for this remarkable experiment.

On Friday, January the 7th, being a fine clear morning, after a very frosty night, and the wind about north-north-west, but hardly perceptible, M. Blanchard, accompanied by Dr. Jeffries, departed in the old balloon from Dover Castle, directing their course for the French coast. The balloon was begun to be filled at about ten o'clock, and, whilst the operation was going on, two small balloons were launched in order to explore the direction of the wind. The apparatus was placed at about fourteen feet distance from the perpendicular cliff; and at three-quarters after twelve o'clock, the boat being attached to the net which went over the balloon, several necessaries, and some bags of sand for ballast, were put in it. The balloon and boat, with the two adventurers, now stood within two feet of the brink of the cliff,—that identical precipice so finely described by Shakspeare :—

> How fearful
> And dizzy 'tis, to cast one's eyes so low!
> The crows and choughs, that wing the midway air,
> Show scarce so gross as beetles. Halfway down
> Hangs one that gathers samphire; dreadful trade!
> Methinks he seems no bigger than his head.
> The fishermen, that walk upon the beach,
> Appear like mice; and yon tall anchoring bark,
> Diminish'd to her cock; her cock, a buoy
> Almost too small for sight. The murmuring surge,
> That on the unnumber'd idle pebbles chafes,
> Cannot be heard so high.—I'll look no more;
> Lest my brain turn, and the deficient sight
> Topple down headlong.

At one o'clock the intrepid Blanchard desired the boat to be pushed off; but the weight being too great for the power of the balloon, they were obliged to throw out a considerable quantity of ballast, in consequence of which they at last rose gently and majestically, though making very little way, with only three sacks of ballast, of ten pounds each. At a quarter after one o'clock the barometer, which on the cliff stood at 29·7, was fallen to 27·3, and the weather proved fine and warm. Dr. Jeffries, in a letter to Sir Joseph Banks, Bart., P.R.S., describes with rapture the prospect which at this time was before their eyes. The country to the back of Dover, interspersed with towns and villages, of which they could count thirty-seven, made a beautiful appearance. On the other side, the breakers on the Goodwin Sands appeared formidable. They passed over several vessels, and enjoyed a view perhaps more extended and diversified than any that was ever beheld by mortal eye. The balloon was much distended, and at fifty minutes past one o'clock it was descending, in consequence of which they were obliged to throw out one sack and a half of ballast, in order to rise again. They were now one-third of the way from Dover, and had lost distinct sight of the Castle. A short time after, seeing that the balloon was descending very fast, all the ballast was thrown out; but that not being sufficient to lighten the boat, a parcel of books was next thrown overboard, when they rose again, being at about midway between the English and French coasts.

At a quarter past two o'clock the rising of the mercury in the barometer showed that the balloon was again descending, which obliged them to throw away the remaining books. At twenty-five minutes after two they were at about three-fourths of the way, and an enchanting view of the French coast appeared before their eyes; but the lower pole of the balloon was collapsed, in consequence of the loss or condensation of the inflammable air, the machine was descending, and they, Tantalus like, were uncertain whether they should ever reach the beautiful land. Provisions for eating, the wings of the boat, and several other articles, were successively thrown into the sea. "We threw away," says Dr. Jeffries, "our only bottle, which in its descent cast out a steam like smoke, with a rushing noise; and when it struck the water we heard and felt the shock very perceptibly on our car and balloon." Anchors, cords, &c., were thrown out next, but the balloon still approaching the sea, they began to strip, cast away their clothes, and fastened themselves to certain slings which proceeded from the hoop to which the boat was fastened, intending to cut the boat away for a last resource; but they had the satisfaction to find that they were rising, their distance from the French shore was about four miles, and they were approaching it very fast. Fear was now vanishing apace; the French land showed itself every moment more beautiful, more extended, and more distinct; Calais, and above twenty other towns and villages, were clearly distinguished. Their actual situation, with the idea of their being the two first persons who crossed the Channel in such an unusual vehicle, made them little sensible of the want of their clothes; and I doubt not but the sympathising reader will feel an unusual sensation of admiration and joy in imagining their situation. Exactly at three o'clock they passed over the high grounds about midway between Cape Blanc Nez and Calais; and it is remarkable that the balloon at this time rose very fast, so that it made a magnificent arch. The balloon rose higher than it had ever done in any other part of the voyage, and, the wind increasing, varied a little its direction. The two adventurers now threw away their cork jackets, which they had taken for safety, and of which they were no longer in want. At last they descended as low as the tops of the trees in the Forest of Guines, and Dr. Jeffries, laying hold of a branch of one of the trees, stopped their progress. The valve of the balloon was opened, in consequence of which the inflammable air got out with a loud rushing noise; and some minutes after they came safely to the ground between some trees which were just open enough to admit them, after having accomplished an enterprise which will perhaps be recorded to the remotest posterity.

About half an hour after they were overtaken by some horsemen, &c., who had followed the balloon, and who showed every possible attention to the fortunate aeronauts.

The next day a magnificent feast, made at Calais, solemnised the event. The freedom of the city was presented to M. Blanchard in a gold box, and the Police of Calais wrote to the Ministry to have the balloon purchased and deposited, as a memorial of the experiment, in the church of Calais, and also design to erect a marble monument on the spot where the intrepid adventurers descended.

Some days after M. Blanchard received an order to appear before the King; and in a letter to Mr. Sheldon, the companion of his fourth aerial voyage, he mentions that His Majesty was pleased to grant him a gift of 12,000 livres, and a pension of 1200 livres a year.

The most remarkable circumstance in the account of this voyage is that of the bottle, the striking of which on the water occasioned some agitation on the boat and balloon. This deserves to be carefully repeated, at another opportunity, before we attempt an explanation of the phenomenon.

The balloon approaching the sea very fast, or, which is the same thing, going very low whilst over the sea, and rising very high when it got over land, has been by several persons attributed to a pretended attractive power of the sea-water; but if the various circumstances which concur in this experiment be duly considered, there seems to be no reason to admit so strange a supposition. It should be recollected that in the two preceding voyages, made with the same machine, it was found that the balloon could not support two men long in the atmosphere; it should therefore occasion no wonder if in the last voyage it showed the same weakness of power. As for its rising higher just when it got over the land, that may be easily accounted for: in the first place, the two travellers threw out their clothes just about that time; secondly, in consequence of the wind's then increasing the balloon travelled at a much greater rate than it had done whilst over the sea, which increase of velocity lessened its tendency to descend; besides which, the vicissitudes of heat and cold may produce a very considerable effect; for, if we suppose that the air over the land was colder than that over the sea, the balloon, coming from the latter into the former, continued to be hotter than the circumambient air for some time after, and consequently it was comparatively much lighter when in the cold air over the land than when in the hotter air over the sea; hence it floated easier in the former than in the latter case.

A monument was raised on the spot where M. Blanchard alighted, with the following inscription:—

SOUS LE RÈGNE DE LOUIS XVI,
M DCC LXXXV,
Jean-Pierre Blanchard des Andelys en Normandie,
Accompagné de Jean Gefferies, Anglais,
Partit du château de Douvres
Dans un aérostat,
Le sept janvier à une heure un quart;
Traversa le premier les airs
Au-dessus du Pas-de-Calais,
Et descendit à trois heures trois quarts
Dans le lieu même où les habitants de Guines
Ont élevé cette colonne
À la gloire des deux voyageurs.

And these verses record the feelings awakened by this incident:—

Deux peuples divisés pour l'empire des mers
Ne font qu'un aujourd'hui en franchissant les airs.
Présage fortuné de l'union sincère
Qui doit régner entre eux pour le bien de la terre.
Autant que le Français, l'Anglais fut intrépide:
Tous les deux ont plané jusqu'au plus haut des airs;
Tous les deux, sans navire, ont traversé les mers.
Mais la France a produit l'inventeur et le guide.

*General Remarks on the preceding History (by Cavallo).*—The art of navigating throughthe air, sought after from time immemorial, has been discovered and so far improved within these two years that above forty different persons have performed the experiment, and not a single instance is known of any person having lost his life in the attempt; and, excepting two or three, who have been hurt in consequence of accidents—owing, not to the principle of the invention, but rather to the want of proper judgment—all have unanimously testified the safety, ease, and beauty of the experiment; and it is very remarkable that no man or woman who ascended into the atmosphere by this new-invented means, experienced any sickness or giddiness, such as is generally the consequence at first of ascending high buildings, or of going in a boat on water. It is justly questioned whether the first forty persons who trusted themselves to the sea in boats escaped so safe.

The method, far from being complicated or troublesome, is perhaps as simple as might have been wished by the warmest imagination; and so easy for the aeronaut that he has absolutely much less trouble with his machine than a sailor with a ship in the most favourable circumstances. With a moderate wind the aerial navigators have often gone at the rate of between forty and fifty miles an hour, but very commonly at the rate of thirty miles, and that without any agitation and without feeling the wind; for, in fact, the wind goes with them, and therefore they are respectively in a calm and without uneasiness. Compare this mode of travelling with any other known method of going from place to place, then judge of the merit and importance of the discovery.

Ignorance, curiosity, and often the supercilious wisdom of the splenetic, ask whether it is possible to bring this discovery to be of any use; and the want of a decisive answer, which it is not in the power of any man to give at present, makes such generally decide against air-balloons; endeavouring to depreciate them still further by the ridiculous idea of emptiness, which has been often allegorically expressed by the words *aerial, full of air, empty balls,* and *bags full of wind.* Some persons often wonder that *air-balloons* should engross the public attention, that they are become the object of scientific societies, and have acquired the patronage of the great and learned. They should first consider how much human attention, human life, human labour, human peace and tranquillity, have been engrossed, disturbed, and checked by unmeaning words and ideal powers; perhaps they would then allow some attention to be bestowed upon one of the greatest discoveries of human industry.

The principal objection started against aerostation is, that those machines cannot be guided against the wind, or in every direction at pleasure; and the enemies of innovations would set aside even the idea of air-balloons, because, two years after their discovery, the subject has not been so far improved as to steer them in any direction whatsoever. But, as the advantages and merit of an invention may be comprehended by comparison better than by other means, it should be considered, that vessels on water cannot be guided against the wind, nor even within many degrees of the contrary direction; and indeed, if the lee-way of a vessel going close to the wind be taken into account, it will be found that, in reality, a vessel at sea can hardly be guided in a direction nearer than a right angle to the point of the wind: for instance, with a northerly wind, a vessel cannot go in a direction above a few degrees northward of east, or northward of west. Now, an aerostatic machine has been carried in a course so far as twenty-two degrees from the direction of the wind, by the use of oars, which were neither all the oars that could have been used nor of the most advantageous construction; so that there is great probability that an improved construction and proper management may enable an aerostatic machine to go across the wind, if not still nearer to the point from whence it blows.

An aeronaut, in the atmosphere, has two advantages which are very considerable; first, that if the wind does not prove favourable, he may descend, provided he is overland; and secondly, as currents of air, going in different directions, have been very often observed at the same time in the atmosphere, the aeronaut may, by ascending or descending into a higher or lower region, go with that current which is proper for him. Indeed, it is not known that those different currents always exist; but it is not unlikely that they, as has been the case with the currents of various seas, may be better ascertained by future experience and investigation; and we have now in our power the means of examining them at any time. The reader should here observe that the above-mentioned means of directing aerostatic machines are not schemes of theoretical projectors, but the produce of experience, and in great measure confirmed by many instances in the preceding history.

The incomparably greater velocity of an aerostatic machine, and its very seldom or never losing time by being becalmed,* are likewise two advantages, which aerostation has above navigation. But as my object is to inform those who wish to know what has been done in this subject, and not to persuade the unwilling, I shall conclude this chapter, and the First Part of my work, with a summary recapitulation of the most interesting particulars that have been ascertained, in order to exhibit to the mind of the reader a comprehensive view of the subject in a few lines.

Two substances having been discovered to be specifically much lighter than common air,—namely, inflammable air and common air when heated,—large bags have been formed which would contain so great a quantity of these substances, as that the excess of weight of a body of common air above that of an equal bulk of hot or inflammable air might be greater than the weight of the bag, or at least equal to it; those bags, therefore, thus filled, being lighter than an equal bulk of the circumambient air, float in it, and are driven by the wind; and for the same reason, a piece of wood in a river floats upon the water, and proceeds with the stream.

As air will not long remain hotter than the surrounding medium, those bags or balloons, which are filled with hot air, must contain a fire capable of keeping the air sufficiently hot; by which means they may continue to float for an indefinite time; otherwise, in a very short time, the air in them cools, and they fall. The other balloons, which contain inflammable air, continue to float as long as a sufficient quantity of that fluid remains in them; so that they would float for ever, if the envelope did not permit any inflammable air to escape through its pores.

It is mathematically true, that the ascensional power of balloons, or their excess of levity above an equal bulk of common air, increases incomparably faster than the proportion of their diameters: for instance, if an air-balloon of a certain diameter can lift up into the atmosphere a weight of ten pounds, another balloon of twice that diameter (everything else, as the thickness of the stuff, &c., remaining the same) will lift up more than eighty pounds; and a balloon of three times that diameter will lift up more than 270 pounds' weight. Upon this principle, balloons have been made of such a size as would carry up any required weight; in various parts of the world men have ascended with them, and have safely travelled through the air at the rate even of about fifty miles an hour.

Wherever those experiments have been made, persons of every rank have gazed with the greatest anxiety, and have shown unequivocal marks of astonishment and satisfaction; the aeronauts, returning from their aerial excursions, have been generally received with the greatest applause, have been carried in triumph; medals have been struck, and plates engraven, in commemoration of the persons who have most distinguished themselves in such performances, or of their particular experiments; premiums and pensions have been granted them by learned societies, and by many great persons, especially by the court of France, whose patronage and generosity, in this respect, must be ever acknowledged and praised by all impartial and discerning people. Thus mankind, by these acts of admiration, of satisfaction and generosity, has shown and confirmed its approbation of the discovery. The vicissitudes of human affairs may at times retard or accelerate the use and improvement of aerostatic machines, but the interest and curiosity of man will doubtless for ever retain the knowledge of the subject—a subject infantile indeed, but endowed with manly features.

It has been often discussed whether the preference should be given to the inflammable-air machines or to those raised by means of hot air. Each of them has its peculiar advantages and disadvantages; a just consideration of which seems to decide in favour of those with inflammable air. The principal comparative advantages of the rarefied-air balloons are—their being filled with little or no expense—their not requiring to be made of so

* An instance of an aerostatic machine remaining in the atmosphere stationary for want of wind, has happened very seldom, and then it has never lasted above a few minutes. And everybody knows that, in the calmest weather, the clouds always appear to be in motion.

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H. Heldsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director.*

1864

expensive materials—and the combustibles necessary to fill them being found almost everywhere; so that when the provision of fuel is exhausted, the aeronaut may descend and recruit his fuel in order to proceed on his voyage. But then they must be larger than the other sort of balloons, in order to take up the same weight; and the presence of a fire is a continual trouble, and a continual danger: in fact, amongst the many aerial voyages made and attempted with such machines, very few have succeeded without some inconvenience of one sort or other; whereas the aerial excursions made with inflammable-air machines have all answered exceedingly well, and in but few instances have the machines been damaged, and then very inconsiderably.—But, on the other hand, the inflammable-air balloon must be made of a substance impermeable to the subtile gas; the gas itself cannot be produced without a considerable expense; and it is not easy to find the materials and apparatus necessary for the production of it in every place. Nevertheless, an inflammable-air balloon of thirty feet in diameter, according to the present state of knowledge, may be made so tight as to be capable of keeping two persons, and a considerable quantity of ballast, up in the air for above twenty-four hours, if properly managed; and possibly one man might be supported by the same machine for three days: and it is very probable that the stuff for these balloons may be so far improved as to be quite impermeable to the inflammable air, or nearly so; in which case, the machine, once filled, would continue to float for a vast while. At Paris they have already attained to a great degree of perfection in this point; and small balloons have been kept floating in a room for many weeks without losing any considerable quantity of their levity: but the method of preparing the stuff is still kept secret. However, there seems to be no great difficulty in making small balloons so very tight; the difficulty is in the large ones; because, in a large machine, the weight of the stuff itself, the weight and stress of ropes and boat, the folding it up, &c., may easily crack or scrape off the varnish in some place or other, which is not the case with small balloons.

As for the dearness of the inflammable air, it must be observed, that divers experiments and observations show that a method of obtaining it incomparably cheaper is not far from being ascertained; and indeed there are several manufactories in which abundance of inflammable air is daily produced, and lost for want of due attention, or of vessels proper to confine it; but, as its utility becomes known, there can be no doubt that means will be contrived to preserve it, wherever it may be abundantly produced; so that we may shortly expect to see repositories of inflammable air, where one may go to fill a balloon for a certain sum.

In regard to philosophical observations, derived from the new subject of aerostation, there have been very few made; the novelty of the discovery, and of the prospect enjoyed from the gallery of an aerostatic machine, has generally distracted the attention of the aeronauts; and besides, many, if not the greatest number of the aerial voyages, though said to be purposely made for the improvement of science, were performed by persons absolutely incapable of accomplishing this purpose, and who, in reality, had either pecuniary profit alone in view, or were stimulated to go up with a balloon for the sake of the prospect, and the vanity of adding their names to the list of aerial adventurers.

The agreeable stillness and tranquillity experienced up in the atmosphere has been a general observation.—Some machines have ascended to a great height, even as far as two miles; they have generally penetrated through fogs and clouds, and have enjoyed the vivifying heat of the sun, whilst the earth beneath was actually covered by dense clouds that poured abundance of rain.—In ascending very high, the aeronauts have often experienced a pain in their ears, arising from the air, within a certain cavity of those organs, being not of the same density as the external air; but that pain generally went off soon after.—There is one experiment recorded, in which the air of a high region, being brought down and examined by means of nitrous air, was found to be purer than the air below.—The temperature of the upper regions is much colder than that of the air near the earth; the thermometer, in some aerostatic machines, having descended many degrees below the freezing point of water, whereas on the earth, at the same time, it stood considerably higher than that degree.—The electricity brought down by strings, fastened to balloons floating in the atmosphere, proves nothing more than what was known before, and had been ascertained by other means, viz. the existence of a continual electricity, of the positive kind, in a clear atmosphere.

Having just mentioned the electricity of the atmosphere, it will be proper to take notice of a sort of danger justly suspected to attend the inflammable-air balloons, and which arises from this principle. It is, that a stroke of lightning, or the smallest electric spark, happening near the balloon, might set fire to the inflammable-air and destroy the machine and the adventurers.—But several considerations seem to render this apprehension of no great weight, though they do not entirely remove it, according to the present state of knowledge. First, this accident never actually happened, though inflammable-air balloons have been up in every season of the year,

and at the very time when thunder was actually heard: secondly, in case of danger, the aeronauts may easily come down to the earth, or ascend above the clouds, viz. above the region of thunder-storms: thirdly, the balloon, made of materials that are not conductors of electricity, is not likely to receive a stroke of lightning, especially as it stands insulated; for it is a maxim pretty well established by electricians, that the lightning, in coming to the earth, does not strike any intermediate body, except that body can assist its passage; thus, a house that contains a great deal of metal, and is situated upon ground that is a good conductor of electricity, especially if near a river, is more likely to be struck by the lightning than a house which stands upon dry and hardly-conducting ground. This has been confirmed by many instances. It may be said that a stroke of lightning may strike the balloon in passing from one cloud to another; but the same reasons which show that the balloon is not likely to be affected in the former case are applicable to the latter: however, at present, it seems impossible to give a proper decisive answer relative to this point; and nothing but experience can show how far the aeronaut may be in danger of the lightning. Lastly, it may be observed, in regard to this circumstance, that inflammable air by itself, viz. unmixed with a certain quantity of common air, will not burn, and consequently, even if a spark of electricity was to pass through the balloon, it would not set fire to the inflammable air, except a hole was to be made in the envelope; in that case the inflammable air coming out of the hole, would mix with the common air, and might easily be inflamed by electricity.

In the course of the preceding history I have scarcely mentioned a word relative to the numberless schemes that have been proposed for directing the aerostatic machines. The projects of this sort have been numerous indeed, but hardly ever had the appearance of probability. Some imagined that an aerostatic machine might be guided by means of sails, like a vessel at sea, forgetting that there is no wind with respect to an aerostatic machine; for it goes with the wind, and therefore is respectively in a calm; in which case the sails cannot act. Others would direct it from the wind by the action of a steam-engine or eolipile: and others again by means of gunpowder fired out of a tube, in a direction contrary, or inclined to the wind. But, without troubling the reader any further with such chimerical schemes, it must be acknowledged that there have been a few projects for this purpose which are far from being groundless, and consequently deserving of notice.

Beautiful cloud! with folds so soft and fair,
Swimming in the pure quiet air!
Thy fleeces bathed in sunlight, while below
Thy shadow o'er the vale moves slow:
Where, midst their labour, pause the reaper train
As cool it comes along the grain.
Beautiful cloud! I would I were with thee
In thy calm way o'er land and sea:
To rest on thy unrolling skirts, and look
On Earth as on an open book;
On streams that tie her realms with silver bands,
And the long ways that seem her lands;
And hear her humming cities, and the sound
Of the great ocean breaking round.
Ay—I would sail upon thy air-borne car
To blooming regions distant far,
To where the sun of Andalusia shines
On his own olive-groves and vines,
Or the soft lights of Italy's bright sky
In smiles upon her ruins lie.
But I would woo the winds to let us rest
O'er Greece long fettered and oppressed.—BRYANT.

CÆLUM IPSUM PETIMUS STULTITIÂ.—*Hor. Ode* 1, *III.* 38.

# CHAPTER IV.

## 1785.

THE CHARLO-MONTGOLFIÈRE—THE DEATH OF PILÂTRE DE ROZIER, AND ITS EFFECT—ASCENTS OF INTEREST TILL 1800.

To see sad sights moves more than hear them told;
For then the eye interprets to the ear
The heavy motion that it doth behold;
When every part a part of woe doth bear,
'Tis but a part of sorrow that we hear.
Deep sounds make lesser noise than shallow fords;
And sorrow ebbs, being blown with winds of words.—SHAKSPEARE.

THE CHARLO-MONTGOLFIÈRE — THE DEATHS OF PILÂTRE DE ROZIER AND M. ROMAINE — REASONING — THE LETTER TO THE 'JOURNAL DE PARIS' — THE ELOGE — TESTU — BRISSY IN A THUNDERSTORM — BALDWIN'S AEROPIDA — THE APPEARANCE OF CHESTER FROM A HEIGHT OF SIX MILES — CHAT-MOSS — EDINBURGH TO CUPAR ACROSS THE FIRTH OF FORTH — "KNIGHT COMPANIONS OF THE BEGGAR'S BENISON" — KELSO — GLASGOW — ST. ANDREW'S "CHURCHYARD" — THE OFFICERS OF THE 27TH REGIMENT — "MANSE OF CAMPSIE" — "DINNA YE THINK THE WORLD WILL SOON BE AT AN END?" — "HELP FROM THE 'BASS ROCK'" — "THE FIRST ASCENT OF MONT BLANC" — THE PARACHUTE — LOUIS BUONAPARTE.

TIBERIUS CAVALLO ends his history—luckily for the remarks he makes—in January, 1785. Had he delayed till June, his last tale would have been a melancholy one; for on the 15th of that month the shout of joy, that had re-echoed over Europe during two years, was rolled back by a wail of dismay at the appalling accident that happened to MM. Pilâtre de Rozier and Romaine.

Public opinion from that time stigmatised as foolhardy, all further attempts to navigate the clouds; and this opinion has been strengthened by the number of inexperienced adventurers, who, for the sake of gain or popular applause, have run needless risks.

Here are the accounts of eyewitnesses; and we may now calmly judge of the correctness of such an opinion:—

This first and boldest of aeronauts desired to crown his successes by the passage of the Channel, but trivial accidents and contrary winds delayed his start for seven months. Meanwhile Blanchard had crossed from England. The many taunts he was subjected to in consequence of continued postponements galled his youthful spirit; and on the 15th June he started at 7 P.M., with Mons. Romaine, under unfavourable circumstances; his last tie to earth having been the hand of the Marquis de Maisonfort, to whom he had refused a seat in his car, in spite of his earnest entreaties, and who remained to write an account of the melancholy death of his friend, and to deliver an eloquent eulogium over him at the Academy of Sciences.

Thousands of people watched their flight with peculiar anxiety, for another step would have been gained in the improvement of the aerostat, should the Charlo-Montgolfière succeed. The advocates of the Mont-

golfière had now had two years' controversy with those who thought the Charlière the best; and it was the ambition of Pilâtre de Rozier to combine the two in this bold attempt.

About thirty minutes only had elapsed since they had left the earth; the S.E. current that carried them out to sea had changed to S.W., that again brought them inland; when a cry arose from those thousands of spectators, maybe more swift and sudden than any that ever emanated from so large a multitude; for at the same instant all beheld the machine in flames; and after many swift, wave-like motions, it fell a shapeless mass upon the ground, on reaching which the unfortunate occupants were found dead. Nothing more remained for them but a funeral; and the following inscription was placed on their tomb:—

Passants, plaignez leur sort, et priez Dieu pour le repos de leurs âmes—
L'estime, la douleur,
Et l'amitié, leur ont élevé
Ce monument, en l'année
1786.
Ardens amis des arts et de la vérité,
Au printemps de ses jours par un noble courage
Le premier dans les airs il s'ouvrit un passage
Et périt au chemin d'immortalité,
Le matin dans les airs comblé de la gloire
Le soir ne reste d'eux que la mémoire
Montrant de l'homme au même instant
Et la grandeur, et le néant.

Ill-tidings fly rapidly; a bad impression was made; and it was in vain that the writer of the following able letter to the 'Journal de Paris,' endeavoured to combat this misconception:—

One cannot doubtless too much regret the death of an amiable young man, full of love to science and victim to his zeal and courage; but wherefore throw upon this invention all the blame of some false combinations or neglect in the construction (of the machine), or perhaps some unforeseen circumstances?

There has never been an invention useful to mankind that has not cost human blood; we need not look far for examples.

Will the immortal Franklin reproach himself for having announced to mankind the identity of lightning with electric fluid, because two physicians have been victims to this discovery?

How many thousands have died from emetics, or the crushing of stone, and must we on this account forbid the remedy or the operation?

Let us remember the time when a balloon first rose from the Champ de Mars, and was lost in the clouds in the midst of Paris, astounded at this physical prodigy, as if a miracle had interrupted the laws of nature. Imagination did not even dare to fancy a human being attached to such a vehicle; and those who ventured to suggest experiments with those under sentence of death appeared to propose something diabolical.

At this timid period, a young man, of an agreeable and taking figure, and of a gentle and happy character, loved by all who knew him, having every reason to love life, volunteered to try the experiment which hardly any one had yet the courage to think of. Every one said he was a fool; but when he had descended from the clouds after crossing Paris, all were ready to look upon him as a being of another world.

Hardly had the novelty been repeated four or five times than the public wished to despise it, and spoke of it as children's play, that required no courage.

The fearful death of Pilâtre de Rozier has re-awakened original fears, and again it is said that experiments should be abandoned after proving so fatal to the man who first made the attempt.

The public is again ready to condemn as a fool him whom they had just admired as the hero of the sciences. Thus is the tide of public opinion carried between contempt and admiration.

There is something surprising in these experiments, which are so alarming to the imagination; it is, that more than a hundred have been made without a single accident. From this one would conclude that the dangers are not so great, when these have all been trials and experiments.

Such is the lot of mankind, that the most happy revolutions, the most useful discoveries, cost sacrifices. Navigation, again, costs mankind thousands of victims; and navigation is useful to man.

Aerostats, it is true, are uncertain, till a way has been discovered for directing them; and this is a problem

yet to be solved. Who will dare say the problem is insoluble, or that its impossibility has already been decided?

I respect the authority of men of science, and I know their value; BUT SCIENCE ONLY COMBINES AND COMPARES KNOWN FORCES; AND ITS RESULTS CANNOT GO BEYOND IT ANY MORE THAN ITS COMPARISONS AND COMBINATIONS. GENIUS AND CHANCE DISCOVER NEW FORCES; SCIENCE SEES WHAT IS ACTUALLY POSSIBLE; CHANCE AND GENIUS EXTEND THE LIMITS OF POSSIBILITIES, AND CREATE, SO TO SPEAK, NEW POSSIBILITIES.

Before the discovery of Montgolfier, Science had announced the impossibility of man ever rising in the air, and it had reason, for it could only combine and compare known forces. Montgolfier appears, and at Annonay creates a new force, and man floats in the air: should it be, at a time when this discovery has extended the limits of possibility to a prodigious extent, that any one should presume to say that it is impossible to extend them yet further?

This discovery has accustomed us to prodigies, and reason has a right to expect new ones; everything promises that the reign of Louis XVI. will yet add this glory to the glory of the first discovery.

Intrepid and persevering men exhaust combinations in their numerous experiments, and chance, so to speak, is searched in all ways.

Genius, at the same time, will watch nature in all directions; and a single observation or a single idea may perhaps be worth a thousand experiments.

The following is the Eloge pronounced at the Academy of Sciences:—

THE ELOGE ON PILÂTRE DE ROZIER, BY THE MARQUIS DE MAISONFORT.

A person must possess well-known talents, and an established reputation, to venture to speak in praise of a man whose cool intrepidity and active knowledge interest all generous hearts. I do not estimate my own powers, but only listen to the dictates of my heart. I conceive, that without being eloquent, we may dare all things when warmly affected.

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Hereafter, on seeing his name consecrated by glory, I will say, if his last expressions of affection were bestowed on me, I *am* the first to strew some flowers on his grave.

He was born March, 1757; the city of Metz gave him birth, but to Paris he dedicated his talents.

Almost unknown in his own country (which he left early in life), the city where he was born knew him only by those rays of glory which he spread over it; and although his fellow-citizens have a right to be proud of his birth, it remains only for us to lament his death.

I shall not touch upon the family of Pilâtre de Rozier. Let it suffice us to know that he was born of virtuous and honest parents. False pride is always founded in mediocrity.

The learned, the artist, and the poet are the children of their own creation, and the eminent man belongs to every class of citizens. The great disadvantage of poverty is, that it deprives us of a generous and distinguished education. A rich man, without talents, is the more blameable, as he has had in his power all the means of obtaining them. Thus, a man without fortune, like Pilâtre de Rozier, has so much the more right to our esteem; because he has vanquished many obstacles to merit it. He was but a mere boy when he was employed in the military hospital; the study of anatomy interested, without fixing him to it. An attraction, which he could not resist, led him to physics and chemistry, and he soon gave himself up (if I may so express myself), to that happy enthusiasm which elevates great men to the place they ought to fill.

At the age of seventeen, without support, without assured resources, he came to this capital, allured by a desire of instruction. He thought, with reason, that Paris was the centre of all learning, and seeking out of his misfortunes new exertions, he determined to attempt all things in order to extend his knowledge.

The laboratories of two able chemists of that city were successively the ports where his youth found shelter during his first storms of life. Running always with equal ardour to attain his end, difficulties disappeared before him, and his daily employments could not retard either his labours or his progress. He found in pharmacy the first elements of that science to which his genius called him.

If its theory had previously seduced him, what charm did he not find in wholly giving himself up to the experiments of physics and chemistry? He attended all the courses, heard all the lectures, read with avidity all

the books. Intelligent, tractable, and studious, he marched with the strides of a giant in this newly-discovered career. Nature had bestowed on Pilâtre de Rozier all the gifts that form the natural philosopher and the chemist. Laborious, daring, who possessed, more than he, the love of that glory which makes us undertake; that patience which makes us execute; and that courage which makes us succeed?

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In 1780 the city of Rheims wanted an enlightened person, capable of all things within himself, and of giving a public course of interesting and instructive chemistry. M. Sage was requested to name a professor; he chose one from among his own pupils, and Pilâtre flies to give lectures at an age that few begin to receive them with advantage. That zeal which first brought him to Paris soon carried him back again. Insatiable of knowledge, Pilâtre, tired with teaching, hastened to return to his own studies.

Commerce, for a time, caught his attention; but, compelled by a passion stronger than interest, he yielded, and returned to physics and chemistry.

Happy then, for the first time, to find himself placed at once under the eye of a Prince (Monsieur, the King's brother), protector of the sciences he honoured, and a friend to the arts he cultivated, he soon merited his regard and his favours. To this invaluable good fortune he had that of serving a generous and sensible Princess, an enlightened judge of talents, and well knowing how to profit by them herself, and how to value them in others. He had the honour to explain to both, the interesting phenomena of physics and chemistry. It was at this period, gentlemen, that reflecting on the infinite difficulties that must be overcome, he resolved to spare much trouble to those whom a love of the arts and sciences should induce to follow him in this immense career. Great ideas are readily generated near great princes. Like the God of day, which spreads around him flames of light, they impress a character of sublimity on all that surround them. Pilâtre de Rozier purposed to reunite in one and the same centre what his genius alone knew so well to comprehend, and, collecting all the scattered parts, to create a place which might draw the whole to a focus. This vast project a man, born without support, dared to conceive and execute.

What obstacles must he encounter! What patience must he oppose to the intrigues of malice! Then it was that he frequently exclaimed, with that sweetness that always characterised him, "The world is just in the end; but it begins always by opposing the good we would do it." Thus answering, by successes, to doubts,—by the evidence of things, to the inutility of words, he succeeded. Monsieur approved his projects; the museum was formed, and we soon saw natural history, chemistry, anatomy, and mathematics united and ranged under the name of the Muses.

It was at this time, gentlemen, that for the honour of human nature, one man dared to resolve the problem of all ages. By the laws of gravity, every heavy body appeared to have a direct tendency to the earth; but Monsieur de Montgolfier calculated and compelled the same laws to produce a contrary effect, and in the end he broke the chain of gravity. Thus truth came in aid to fable, and that which the imagination of poets invented, the genius of one man realised.

A person must have courage, gentlemen, to combat and to attempt that which prejudices had declared to be impossible! What thorns are planted in the paths of the learned by that same public they attempt to instruct and enlighten! Men, extreme in all things, are always lavish of praise or censure, and we have frequently seen them leave genius combating with mediocrity.

In the month of July, 1783, Monsieur de Montgolfier, already announced to Paris by his fame, arrived there to evince this discovery. A globe was elevated to the eyes of the astonishing capital, and the field of Mars became for aerostation the first field of triumph. Then it was, that delivering himself to that enthusiasm which inspires great things to souls formed to perceive and appreciate them, Pilâtre de Rozier dared to solicit that which no person had ever ventured to foresee. The idea of a man in the middle region of the air, trusting his existence to feeble and weak substances, froze all hearts; his alone remained unshaken.

He solicited the place, which was for a long time through humanity refused him, and he requested that, as a favour, which a beneficent King trembled to substitute as a most dreadful punishment. Think not, that the desire of glory alone could stifle in him that attention which attaches us to this life. It is to the public good that such prodigies belong, that alone can carry us above the terrors and common prejudices. And, if we have sometimes seen people seek death in hope of acquiring an immortal name, it is more noble to brave it with design to make ourselves useful. Let me here consecrate what he has so often said to me, "We have lived long enough when we have added something to humanity."

After many successful essays, Monsieur de Montgolfier consented to the repeated wishes of Pilâtre de Rozier, and the empire of air became the patrimony of man.

There existed two methods, both perhaps equally dangerous, but attaining one and the same end, though by contrary processes. A choice must be made, and the inventor seemed to give a decided preference to fire; more simple, more ready, more saving, this method announced a more real utility, and advantages within every one's power.

From this time aerostation was divided into two parties. M. Charles sustained with success the method he adopted, and Paris saw the most celebrated artists balancing between the Air Balloons and the Montgolfiers. Always happy when a noble emulation is the only sentiment that divides two rivals! Happy when they know *how* to set a due value on, to calculate their power, and to merit their esteem; especially to have the commendable pride of despising envy, of braving the prejudices of the moment, and of adopting posterity only for judge, alone competent to pronounce its irrevocable decrees.

The 21st of November, six months after the discovery made by Monsieur de Montgolfier, two adventurous mortals abandoned themselves to all the risks of an element till then unknown.

Pilâtre de Rozier and Monsieur the Marquis d'Arlandes participated a triumph, so much the more flattering, as it was without example.

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To pass from France into England, through the region of the air, required new audacity. This idea is hinted to Pilâtre de Rozier; he adopts it, and we soon see him on the coast waiting for the decrees of fate, and one of the three only winds that could be favourable to him.

Blanchard! the happy Blanchard arrives at Dover, forming the same design on the opposite coast; fortune smiles on him, and the wind, more favourable, brings him triumphantly into his native country.

Incapable of feeling the sting of envy, as just as generous, Pilâtre waits for him at Boulogne, crowns him with his own hand, and goes with him to Paris without fearing to increase his triumph. Not imagining that he himself had done anything, he sees the success of another, and wishes to excel him. Encouraged by the most powerful motives, he sets out; but not without a most painful presage.

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I will not tell you that, during six months, he passed his time in the most frightful uncertainty! The days in getting ready his machine—the nights, in consulting the winds! Thrice he filled it; three times he was seated in the gallery, where I have seen him lying down broken-hearted; and three times the inconstant winds rejected his vows and destroyed his hopes!

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To draw greater advantages out of the system of aerostation, Pilâtre had resolved to unite them;—such was his genius and character. I will not defend what he is accused of, either as to rashness or imprudence, nor lose in discussing a *time*, which ought to be employed in feeling. Let us leave it to persons less affected to defend the cause of a truly afflicting and deplorable misfortune. Let us rather call to mind his last moments; for they will never be obliterated from my remembrance. I saw him restless, melancholy, the whole night consulting the winds, and dreading their inconstancy. In vain I implored him to take some repose; he answered me, "There is no more rest for me; I must set off. I must cross that sea, although it swallows me up. It is the only gate that remains to me, in order to return to my friends." I pressed him to take some sleep; he refused,—alas! he, unfortunate, knew not that death was the sleep that awaited him.

I heard him say, showing me England, "My fortune, my glory, and my life are all on that side!"

It is with the most heartfelt emotion that I recall, gentlemen, the moment when his generous friendship saved my life! He clasped me in his arms, and, trying to shake my constancy, he attempted to frighten me with the danger he foresaw, and feared for me, whilst he dared it himself. "No," says he to me, "It is not a certain wind—it is not a sure experiment!" I yielded! So true it is that circumstances will sometimes take an ascendancy, which we can neither conquer nor define. At last the fatal moment approaches—the fire is lighted—my hands alone still keep my friends to the earth. They escape me! They fly upwards! They ascend with majesty! My eye follows them, and I breathe with difficulty. All my senses are suspended; I, most unfortunate, still envy them! Already thirty minutes are elapsed in this violent agitation.——I hear shrieks all around me; horror environs me; it hath already laid hold of my heart! A rapid motion accelerates and brings back the

machine to the earth. I see it—but in an instant it disappears from my sight—it is over—no more hope remains for me!

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[A few minutes after their ascension, the translator of this Eulogium spoke to the Marquis, who seemed much afflicted, and answered with his handkerchief to his eyes. As soon as the Marquis perceived the accident, he mounted his horse and was the first from Boulogne to witness the cruel fate of his beloved friend.]

It has pierced my soul! Since there are degrees of grief which we may feel, but can never express.

No radiant pearl which crested fortune wears,
No gem that, twinkling, hangs from beauty's ears,
Not the bright stars which night's blue arch adorn,
Nor rising suns that gild the vernal morn,
Shine with such lustre as the tear that breaks
For others' woe down virtue's manly cheeks.—DARWIN.

I conclude saying,—Would you prolong his glory? would you honour his ashes? Then encourage and give splendour to a Museum which was of his creating.

May the Belles Lettres which are there united add, if it be possible, new lustre to it; and that from this enchanting union may there spring up an establishment worthy to bear the name of "Temple of the Muses."*

Calmly reviewing the melancholy incident that called forth these eloquent expressions of sorrow, we may now, perhaps, wonder that such a dangerous essay could ever have been made even by such an adventurous experimenter; but, far from concluding that all future attempts should be abandoned, we ought with greater energy to carry out such trials as have been found to be safe, and have a reasonable probability of success.

On the 18th of June, 1786, the following remarkable experiment was made by Testu-Brissy. These are his own words:—

Having been engaged since the commencement of aerostation in discovering a method for making taffetas impermeable, I succeeded, and made an aerostat seventeen feet in diameter, in which I left the Gardens of the Luxembourg in the presence of Count Nullenburg and a large concourse, at 4.51 P.M., with the ascensional power of five pounds.

Having acquired more lightness on account of the heat drying the net, which had been wet by the morning's rain, *I descended by the aid of my oars* in the Plain of Montmorency to obtain more ballast. Curiosity made people run from all parts and surround me. The proprietor of the field, supported by some vineyard-keepers, wished to make me pay for the damage done; and when I objected, he broke my oars and took my coat.

I bade farewell to such inhospitality, and again descended at 6.45, P.M., near the Abbey of Bozaument, following the river Oise. At 8 P.M., I put foot on ground, to get rid of my broken oars, and take in more ballast. Some sportsmen informed me that I was halfway between Ecouen and Wariville. On leaving I rose above some electric clouds, to a height of three hundred toises. The thermometer was 5° below freezing point. The car was covered with icicles, and I had to throw out the snow and ice that encumbered me.

Night coming on, I lowered, and found myself in the midst of clouds, which were sending forth vivid flashes of lightning and loud thunder, and perceived that clouds attracted or repelled me according to the amount of their electricity. A flag which carried the arms of France in gold sparkled with light. According to my elevation, by means of an electric needle, I could discover whether the current was positive or negative.

I remained more than three hours in this storm-cloud, and the only damage effected was the loss of gilt on the flag, which was perforated with holes by the force of natural electricity. I may here observe that the thunder did me less harm than the peasants of Montmorency.

A calm succeeded, and I remained stationary, making the most of my time by taking refreshment. Finding

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* A monument is intended to be erected upon the spot where they met with their disaster, and the following epitaph designed for de Rozier.

Victime avoué de la rigueur du sort
Le chemin de l'honneur t'a conduit à la mort.

the ballast was running short, I descended, at 3.45 A.M., in the village of Cumprein, where I was well received by the Curé. Testu-Brissy adds, further, that in his flight of eleven hours he made other experiments, some of which he thought would lead to the discovery of the method of guiding balloons; but he would not talk of them till he had completed his trials.

A few months later Testu-Brissy ascended on horseback, without either tying the horse to the car, or perceiving in the noble animal the least fear. This experiment was to prove whether his assertion was true with regard to large animals, that their blood, being apparently less fluid than man's, would yet flow from the nose at a much lower elevation; and this was found to be the case.

The 'Airopaida' (with illustrations) appeared in 1786, giving the accounts of experiments made at Chester, in September, 1785, by Thomas Baldwin, Esq., A.M. The style, as may be imagined, now appears quaint; and, for amusement, I will note some peculiarities, which will assist us in forming an opinion of how much the manner of thinking has changed since that period.

He regrets, in his introduction, that the many aerial voyages preceding his should not have been recorded; and he now undertakes to explain to the "bulk of mankind, which are by far the greater number," what they had not yet experienced. He also writes his narrative for the "Generality, and not for the Curious and Philosophic only."

He rises from the Castle-yard at 1.40, with a levity of 20 lbs., liberated by Mr. Lunardi, amidst acclamations, mixed with tears of delight and apprehension, the misgivings of humanity, &c.

He compared the appearance of that city to a coloured map, its blueness contrasting with the redness of the Dee. "The blue is owing to the stones called slates," then unknown in the south of England. The concave appearance of the earth, the beautiful iris surrounding the shadows on the clouds, next attract his attention, but their description I will leave to another.

He takes out his note-book and pencil, "but a tear of pure delight flashes in his eye! of pure, exquisite delight and rapture," &c. . . . . The imagination was more than gratified, it was overwhelmed.

The report of a cannon awakes him from this reverie, and informs him that he is becoming invisible to those on earth. Looking at his watch, he finds it 2.10½ P.M. By an after comparison, he found that it took thirty seconds to reach him; and, from this, he calculates the height as 6½ miles. A shout two minutes later reaches his ear, and informs him that he is no longer in sight.

Observing the Welsh coast he commences to descend, and perceives that the under current is from the sea. On entering it the gas contracts; he descends rapidly, and swiftly writes, "No more remarks, mind ship." By throwing out ballast, he touches the ground so lightly that his watch and thermometer, lying on the seat, are not displaced. He finds the hour to be 3.28, and the distance from Chester twelve miles.

Two minutes later he again rises, 31 lbs. lighter, and the sea-breeze at starting carries him over Ashton Hall. He compares his rapidity to that of a skyrocket, and reaches a greater altitude than on his previous ascent; and thus does he give vent to his feelings:—"For a while detached, far detached from earth, and all terrestrial thoughts; rapt in the

mild azure of the ethereal regions; suspended in the centre of a vast and almost endless concave; come as a mere visitor from another planet; surrounded with the stupendous works of nature, yet above them; the glorious sun except, which enlivened all, and shone with pure celestial lustre. A peaceful serenity of mind succeeded; an enviable Εὔροια, an idea of which it is not in the power of language to convey or describe." *

He remarks as curious that the thermometer is at 60°, and warmer than the sea-breeze. He also breathes freely, nor did the pulse quicken. Bladders filled with air, attached to the car, in case of a descent in the sea, crackle and look like bursting. He tries experiments with the valve, and alternately rises and falls. The country people said that he appeared to be " quivering and warping in the air."

He suggests balloon geography, in which maps should be drawn with a camera-obscura, aided by a micrometer applied to the underside of the transparent glass; and notices the predilection balloons have for becoming stationary, even in a strong gale, over channels and rivers.

At 3.47 he could not recognise the country. He sees through the clouds what appears two red handkerchiefs, surrounded by a green border. It excites his curiosity; he descends into the smaller, with a uniformly retarded motion, and alights as "the down of a thistle" at 3.54 P.M. The country people come wading to him ankle-deep, and inform him he is in Rixton-moss, twenty-five miles from Chester; the other, of handkerchief appearance, being the famous Chat-moss. Till sunset he amused the country people with rides in the balloon, conducted by a rope, along the turnpike. From his own observation he makes the following remark:—" It is from frequent experiment only that diminution of objects presupposes distance."

The Pindaric Lunardi, whom I have already quoted, in a second series of letters to his guardian, describes, with all the liveliness of youth, and the warmth of an Italian imagination, his aerial voyages in Scotland, in the month of October of this year.

His first flight was on the 5th of October, from Heriot's Gardens, Edinburgh. Rising at 3.45 P.M., he says:—" The city of Glasgow I could plainly distinguish, also the town of Paisley, and both shores of the Forth; but my intention was now diverted by finding myself immediately over the Firth of Forth, at an altitude of 2000 feet. I descended within 500 feet of the water, to inform the boats that it was needless to follow me; then, rising to the clouds, found the upper current was in an opposite direction. The northern coast, trending away in the distance, was now one of the most remarkable objects in view. At 4.20 P.M. I descended at Ceres, after a voyage of forty-six miles, thirty-six being over water, and was conveyed in triumph to the town of Cupar," where he received an address from the club of gentlemen Golfers.

The Rev. J. Arnot, of Ceres, thus describes the descent he had witnessed:—" Yesterday afternoon, the sky being clear, and a breeze from S.S.W., whilst overlooking the stacking of some corn, a boy who was standing by me took notice of what he thought was a hawk.

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* Meditation here
May think down hours to moments. Here the heart
May give a useful lesson to the head,
And learning wiser grow without his books.—COWPER.

I looked, and perceived a globe nearly six inches in diameter. I knew Mr. Lunardi was to ascend from Edinburgh, so I immediately gave information that this was his balloon. It was then 3.55; at 4.10 the balloon descended below the clouds, and, as it drew near the earth, appeared to sail along with a kind of awful grandeur and majesty. At 4.20 P.M. anchor was cast, and we ran up to give assistance. Mr. L. told me the barometer had stood at $18\cdot\frac{15}{10}$, the thermometer below freezing-point."

On his return to Edinburgh he was made a burgess and guild-brother of the city; also a member of a merry society called "Knights Companions of the Beggar's Benison." The following is the diploma:—

"JAMES LUMSDAINE, Preses.

"By the supereminently beneficent and superlatively benevolent Sir James Lumsdaine of Innergellie, Sovereign of the most ancient and most puissant Order of the Beggar's Benison and Merryland, in the thirteenth year of his guardianship, and in that of the Order 5785.

"Having nothing more sincerely at heart than the happiness and prosperity of our beloved subjects, the inhabitants of our celebrated territories of Merryland, and the encouraging of trade, manufactures, and agriculture in that *delightful* colony: and whereas we are fully satisfied that Vincent Lunardi, *armigerum lucœnsis*, has all manner of inclination as well as sufficient abilities, and other necessary qualifications, for promoting these noble and laudable purposes; and willing that such bold adventurers should have all suitable encouragement; we do hereby create, admit, and receive him a Knight Companion of the most ancient and puissant Order of the Beggar's Benison and Merryland, by the name, stile, and title of Sir Vincent Lunardi, to be used and enjoyed by him in all time coming, with our full powers and privileges of ingress, egress, and regress, from and to and to and from all the harbours, havens, creeks, and commodious inlets upon the coasts of our said extensive territories at his pleasure, and that without payment of toll, custom, or any other taxes or impositions whatsoever.

"Done at the Beggar's Benison Chambers of Anstruther, upon this tenth day of the month, known to the vulgar by the name of October.

"Witness, I the Recorder,

"P. PLENDERLEITH, D.R."

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## LUNARDI'S SECOND SERIES OF LETTERS.

### LETTER I.

MY HONOURED FRIEND, Kelso, October 20, 1785.

I did not propose to write again till I had ascended from Kelso; but time tempts me with a few leisure moments, and I am thoroughly convinced that I cannot employ them better than in corresponding with my worthy guardian.

I have now been four days here, three of which I have passed in preparing for my aerial voyage; and everything being in readiness last night, I went this morning, in high spirits, to amuse myself at the race-ground.

The weather was fine, and the concourse of people very considerable; the box was crowded with the most respectable company; but the number of ladies was less than I expected.

The races afforded me much entertainment; for though but few horses entered, they were very swift, and the riders excellent.

My attention, however, was more strongly fixed upon a match between the Duke of Hamilton and Robert Baird, Esq., both of whom rode their own horses. Never did I behold a more admirable spectacle! My ideas rolling back through the wide channel of history, reverted to the Grecian States in the meridian of their glory. Methought I saw two heroes contending for the prize in the Olympic Games! Starting from the barrier, they skimmed lightly over the plain, hailed by an universal burst of applause. Equally rapid the two coursers moved as if both were animated and directed by the same spirit. Expectation fixed the crowd a while in silence; but soon the murmurs began to rise: at first, gentle as the sounds from a well-regulated hive of bees, they seemed but to float on the wind: by degrees the noises increased; and now the shouts of admiration and encouragement, the loud articulations

of hope, the exclamations of joy, clamours of suspense rent the very air! A few moments were likely to determine the victory; the Duke and his antagonist exerted their utmost efforts; their horses flew, and scarce appeared to touch the earth. Every eye was fixed upon them, and every heart panted as agitated in favour of one or the other of these eager competitors. The goal was in view; they darted forward with the velocity of lightning, and both reached it at the same instant, without the least perceptible difference! The race was still undecided; the palm of glory was not yet awarded. They started again; again the same applause, the same emotions, took place; every one was anxious to see the termination of a contest so nobly pursued: once more they touched the goal at Mossa, and now only differed by the breast of one of the animals.

I cannot express the pleasure I took in this sight; more especially as it was to me quite new and surprising; as you know, in Italy, people of rank never show themselves to the public in such a conspicuous manner. Frankly speaking, I own I highly approve this custom, because it must, in a short time, cause the gentlemen of distinction to excel in horsemanship.

The races here are supported by subscription. The gentlemen bring ladies along with them; they all dine together; after which the latter retire to dress, and are the first to enter the ball-room, whither they are soon followed by the gentlemen. It is not uncommon, in this small country-town, to find in the evening a most brilliant and numerous assembly.

The happiness I here enjoy does not proceed merely from the civilities and attentions hourly shown me, but from the many opportunities of observing manners and customs calculated to preserve the peace and welfare, and heighten the pleasures of a social and deserving people. There is but one reflection to damp my joys,—you are not here to share them with the too fortunate

VINCENT LUNARDI.

P.S.—My next shall, I hope, give you the particulars of my aerial journey, of which you need be under no apprehension, as this is an inland town.

## LETTER II.

MY DEAR GUARDIAN, Edinburgh.

On my return to Kelso, I instantly wrote down the particulars of my voyage, intending to transmit them to you without loss of time; I was, however, prevented by the impatience of the people there, who handed them from one to another, till at last they got into the public newspaper. That I may gratify my wishes, therefore, in making known to you the circumstances of my journey as speedily as possible, I shall, without ceremony, insert what appeared in the Kelso paper, which you may credit as every way authentic:—

"KELSO.—Last Friday being the day appointed for Mr. Lunardi to ascend from the churchyard here, about eleven o'clock forenoon two cannon were fired, to give notice that he had begun to fill the balloon, the process of which succeeded to admiration. At half-past twelve two guns were fired as a signal that the balloon could support itself. At one o'clock other two guns were fired, as a signal for the attendance of the ladies and gentlemen, as his departure was approaching. A quarter before two o'clock, the balloon being sufficiently inflated, he attached the car to it, and put therein a basket full of provision, four bags of dry sand for ballast, a grapple, several small ropes, a barometer, thermometer, compass, quadrant, &c. He then got into the car himself, and ordered the balloon to be carried into the middle of the churchyard; and giving the signal for two guns to be fired, he rose perpendicularly from thence, at two o'clock precisely, in a grand and most majestic manner. Immediately on the rising of the balloon, Mr. Lunardi stood up in the car, took off his hat, and bowed to the spectators. At a greater height he threw out his flag, which is forty-eight square feet, and was fastened to the car by a cord of one hundred and fifty feet in length. About ten minutes past two he entered a thin cloud, which pretty much obscured the balloon; but he soon came out of it. At twenty-one minutes past two he entered another cloud, in which we lost sight of him about four minutes, but the flag was still discernible below the cloud. When he again became visible, he was seen going below all the clouds horizontally to the east. About fifty minutes past two he was lost to the naked eye, though several with glasses say they saw him longer.

"To those who were not present, it is impossible to give any idea of the beauty and grandeur of the spectacle, which could only be exceeded by the cool and intrepid manner in which the adventurer conducted himself; and indeed he appeared more at his ease than the greater part of his spectators. The multitude assembled was very great, but had the day of his ascension been generally known in the country, we doubt much if the churchyard,

large as it is, could have contained all that would have been assembled on the occasion. So anxious were all ranks to be present, that, although it was market-day, most of the shops were shut by one o'clock.

" The balloon, which contained about five hundred yards of taffeta silk, was shaped like a pear, thirty-three feet high, and twenty-three in diameter, with a netting over it, and striped with different colours. The car had a bottom of thin board, with a small netting round it, ornamented at the top with pink silk, fringed with gold lace. Mr. Lunardi was dressed in scarlet.

" Mr. Lunardi has favoured us with the following particulars of his voyage, which is the second that has been performed in Scotland :—

" As soon as he got up, he could plainly perceive the sea, and that his course was towards it. Twenty minutes after his ascending with his balloon he got into a cloud, and lost sight of the earth; he might have gone through it to enjoy the higher region, where there is always a fine clear sky, but thought proper to keep himself down, to give pleasure to the spectators. At twenty-five minutes past two he was only four thousand feet above the surface of the earth; he then, observing the sea to be about ten miles from him, began to ascend higher, and when at the height of six thousand feet, the west wind above was stronger than below. He went through the cloud, and for two minutes observed the clearness of the sky above, and the thickness of the clouds beneath; his intention was to go in search of another current of air, but having no signals above for it, and being so near the sea, he thought proper to come in sight of the earth again, which he effected in three minutes. At three o'clock precisely he was no higher than three thousand feet from the surface of the earth, and went horizontally at that height for five minutes; he then began to descend, as he thought the sea to be no more than a mile from him. At twenty minutes after three he anchored at Doddington Moor, about four miles north-east of Wooler, where several country people were collected, but they were afraid to approach him. He called to them, and after repeated entreaties they at length came up to him. Mr. Lunardi then inquired how far he was from the sea, and they told him four miles. Here Mr. Strother Ancrum, who had followed him on horseback for two miles, came up and shook hands with him. He desired six of the country people to draw him with the ropes to Berwick, but after having carried him two miles, the wind blowing fresher, and in an opposite direction, the men were not able to hold the balloon. He came down in a field at Baremoor, where he emptied the balloon, with the assistance of the people who were coming from every quarter. When Mr. Lunardi alighted he had sixty pounds of ballast remaining, which made him regret much his not being able to proceed farther on account of the sea being so near.

" Amongst the people who came to congratulate his safe descent, Mr. Lunardi took much notice of the two Miss Halls of Thornton, Miss Wilkie of Doddington, and Miss Car of Newcastle. He gave much praise to Mr. Richard Thompson of Baremoor, who, after giving Mr. Lunardi every assistance in his power, ordered the balloon to be carried to his house, and politely insisted on Mr. Lunardi accepting of his horse home. Mr. Lunardi spent the night at Mr. Thompson's house, where he was entertained in the most hospitable manner, and after breakfast set off for Kelso, where he arrived on Saturday at one o'clock afternoon. He was met upon the bridge by a great number of the townspeople, and rode in triumph to the Cross Keys Inn, with his flag displayed on the top of the chaise, the bells ringing, drums beating, and the people huzzaing, to welcome him on his arrival.

" On Saturday he dined with Sir James Douglas, and supped with the gentlemen of the Caledonian Hunt. On Sunday he was entertained by Sir James Pringle, at Stitchill; on Monday by Lord Home, at Hirsel; and on Monday evening by our ancient Lodge of Freemasons, of which he was admitted a member. On Tuesday, about noon, he set off for Edinburgh.

" Mr. Lunardi's course was due east (till the end, when he was carried a little to the south), continued an hour and twenty minutes, travelled twenty-five miles; his highest elevation, when above all the clouds, was seven thousand seven hundred feet."

About two hours ago I reached Edinburgh, in good health, and could not permit the post to depart without acquainting you with the whole transaction. In my lodging I found several letters; in particular two from the most respectable people in Glasgow, inviting me thither; I must therefore pay a visit to that city as soon as possible; and I hope, in a few days, to write you from thence, and assure you once more how much I am and ever shall be, your obliged and grateful

V. Lunardi.

## LETTER III.

MY DEAREST FRIEND, Glasgow.

I am already as well known in this city as if I had resided in it some months. About seven o'clock in the evening I arrived here, and was immediately favoured with the visits of several gentlemen who had been witnesses to my ascent from Edinburgh. As I passed through the streets in the morning, a thousand eyes were fixed upon me; and if I remained in view for any considerable space, I had the pleasure of seeing the windows filled with eager beholders.

My first visit was to the chief magistrate, who received me with the greatest civility, and seems a mighty honest, worthy, and well-meaning gentleman. I lodge at the Tontine Hotel, adjoining to which is the most elegant coffee-room I have seen in Europe. The city of Glasgow is in general very neat; the streets broad, well-paved, and intersecting each other at right angles, give it a far more regular appearance than the metropolis. The people apply themselves with unceasing industry to commerce and manufactures, which are carried to such an extent as to make Glasgow justly reckoned the richest city in Scotland. I could not help also remarking the great friendship and hospitality which subsists in this part of Caledonia; the inhabitants not only visit each other frequently at their own houses, but each shop has such a communication with its neighbour that every commercial transaction is presently known through the whole city; and hence any merchant is able to direct one with certainty where to find a piece of goods, though he may not have it in his own shop.

A few days after my arrival I became acquainted with one Mr. Ingram, who seems very much interested in my behalf, and by him I was introduced to Mr. French, a merchant of this place, uncommonly popular for his generosity and openness of heart. He was formerly Provost of the city, and though another is now invested with that dignity, he still retains the title of Provost French.

The University of Glasgow is one of the most complete that can be imagined, well calculated for diffusing every branch of science, and they have an excellent Observatory, charmingly situated in their extensive garden.

As this garden seemed to me the most eligible place for my ascent, I applied to the Professors for it; but they in a polite manner declined granting my request, on account of many young trees which might be injured by the concourse of people. I was therefore advised to open a subscription for defraying the expense; which accordingly was done three days since, but it goes on slowly.

I have had many rambles through the city, but can find no place that will answer my purpose. I do not like to run the hazard of losing a *considerable sum;* but, on the other hand, I am treated with so much cordiality and civility, that I know not how to resolve, so as at once to clear my heart and head from any disgraceful reflections; but I am fully bent to acquaint you in my next with the final determination of your

VINCENT LUNARDI.

## LETTER IV.

MY HONOURED FRIEND, Glasgow, November 22, 1785.

Everything is settled and ready for my excursion; and, if the weather proves favourable, I shall go up to-morrow.

The day after my last was written, I went to St. Andrew's Churchyard, which indeed may be overlooked in every part, but the avenues are remarkably well fenced, for which reason I thought it would be convenient for all those who had purchased tickets. I instantly applied to the magistrates, who very readily allowed me the use of it; in consequence of which I advertised that, without waiting for the subscription, I intended certainly to ascend on Wednesday, trusting that the ladies and gentlemen of Glasgow would not permit me to be a loser by my ascension. And indeed, I am already convinced that will not be the case, as I have been informed that, if the money arising from the exhibition shall prove deficient, they will immediately make up what is wanting; and I know that in the course of this day tickets to the amount of fifty guineas have been disposed of.

By the desire of many principal inhabitants, I have exhibited my balloon in the Old Church choir, where it was no sooner inflated than such a crowd of people assembled as I do not ever remember to have seen in a place of the kind before; so that, one way or other, money enough will most probably be collected.

I have also the pleasure to inform you that in consequence of an application to Colonel Ferguson, Commander of the 27th Regiment, accompanied with a card from the magistracy, I shall be attended by a good number of soldiers; and during the process of filling the balloon the band of the regiment will entertain the company with martial music.

By a perusal of all my letters you will find that my spirits have in general been raised and depressed alternately. Nothing, however, has been able to conquer my resolution; and I have so often shown myself superior to *Misfortune*, that I think she is by this time tired of persecuting me; therefore I subscribe myself, as cool, collected, and happy as ever,

Your sincere friend,

V. LUNARDI.

## LETTER V.

DEAR SIR, Glasgow, November 25, 1785.

Success has overpaid my expectations! I am returned to the caresses of my surrounding friends; and, in token of gratitude, shall make a second ascension on Monday next. You will imagine that I ought now to be sufficiently acquainted with the air, and perhaps call this rage for flying *mere madness;* but give me leave to urge a childhood proof, that whatever our ideas may be in the bud, they shoot into habit, grow as we grow, and with our souls expand, till they become absolutely constitutional. When quite a schoolboy I used to look with contempt upon the creeping worm, or shard-borne beetle; while my eyes were fixed with rapture and admiration upon the busy bee and gilded dragon-fly. I was not fond of quadrupeds; the tricks and gambols of the playful squirrel, or the frolicsome caresses of the spaniel, afforded me little or no amusement. But birds were my delight! I could listen to their songs with inexpressible pleasure, and with the most eager attention survey their rapid flight through the air; they were objects of my love and envy. Is it then to be wondered that I court their company and emulate their mode of living?*

Previous to the detail of my very successful expedition, I shall insert a paragraph from the newspaper, the publisher of which must be a person who understands something of Aerostation, as he describes my apparatus better than any other writer that has attempted the subject.

"AN AUTHENTIC ACCOUNT OF MR. LUNARDI'S AERIAL EXCURSION FROM ST. ANDREW'S CHURCHYARD, GLASGOW, ON WEDNESDAY, THE 23RD INSTANT. (Extracted from the 'Glasgow Advertiser,' November 28th, 1785.)

"On Wednesday last Mr. Lunardi fulfilled his promise in ascending in his aerial car from this city. He came to the place appointed at eleven o'clock forenoon, in company with the officers of the 27th Regiment, preceded by the musical band, and followed by all the soldiers under arms. After they had taken their stations at proper places, everything was got ready for beginning the operation about twelve. The balloon was suspended at the east end of St. Andrew's Church, by a rope stretched between the top of the church and the ground at some distance. Three very large casks with iron hoops were sunk to some depth in the ground, for the purpose of containing the oil of vitriol and iron necessary for the operation. These casks were furnished with large tin tubes, which, passing through a large vessel of water to cool the vapour, united into one, round which the mouth of the balloon was tied. Upwards of a ton weight of iron shavings were divided among the casks, and five or six tons of water along with them. A large tub lined with lead in the under part, with a hole in the bottom, was used as a funnel. This hole was closely stopped up with a stick, until the quantity of oil of vitriol destined for each cask was put into it, when, by pulling out the stick, the whole quantity rushed in at once. There were sixteen large bottles of oil of vitriol used, in all containing upwards of 2000 pounds. On mixing such a quantity of heterogeneous substances together, a tumult, effervescence, and heat were instantly generated to such a degree as cannot be conceived by those who have not been eyewitnesses of similar operations. The vapour instantly issued out with great velocity, and ascending in the balloon, began to swell it first at the top, so that it became quite round and full there, while the under part remained quite flaccid. By degrees the swelling proceeded downwards, and the net with which the balloon was covered began to embrace it closely. About half an hour after twelve it was inflated sufficiently to carry its own weight, so that the rope by which it was suspended became no longer necessary, and was therefore taken

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* We loved to watch the swallow swimming high,
In the bright azure of the vaulted sky,
Or gaze upon the clouds, whose colour'd pride
Was scatter'd thinly o'er the welkin wide,
And tinged with such variety of shade,
To the charm'd soul sublimest thoughts convey'd.
In these what forms romantic did we trace,
While Fancy led us o'er the realms of space;
Now we espied the Thunderer in his car,
Leading the embattled Seraphim to war,
Then stately towers descried, sublimely high,
In Gothic grandeur frowning on the sky;
Or saw, wide stretching o'er the azure height
A ridge of glaciers in mural white,
Hugely terrific.

KIRKE WHITE.

away. The wind struck one side of it considerably, which rendering the operation of filling somewhat difficult, it was pulled down by means of the net and cords affixed to it, as close to the ground as possible, which removed that difficulty. It was kept in this position till about half an hour after one; and though the smell indicated some loss of inflammable air, yet, considering the large scale on which the operation was conducted, we cannot help thinking that the chemical part was performed with great dexterity.

"As the balloon now began to pull very strongly upwards, it was no longer confined, but gradually suffered to rise to its full length, when it appeared of a beautiful oval shape, but still somewhat flaccid in the under part. The car being now appended, Mr. Lunardi took his place, dressed in his regimentals, amidst the anxious expectations of the spectators. At a quarter before two the balloon, now floating with Mr. Lunardi in it, was conducted to some distance from the church, in order to give a more full view of his ascent. It was then let go, and began to rise somewhat slowly; but Mr. Lunardi soon quickened it by throwing out a sand-bag, and as its ascending power was not yet answerable to his wishes, he in a few minutes threw out another, and after that a third. Thus the balloon rose with great rapidity, to the admiration of every one who saw it, and being impelled by a brisk gale, flew also with immense velocity in a S.E. direction as it ascended; and during this ascent Mr. Lunardi gradually lowered his flag to a considerable distance from the balloon, which occasioned no little uneasiness among the spectators, many of whom imagined that the car was getting loose and falling away. In about a quarter of an hour our adventurous hero was lost in a cloud, to the great concern of the spectators, and though a glimpse or two of the balloon were afterwards obtained, it was impossible to view it distinctly for any length of time. He was seen passing over Hamilton at two o'clock, so that he must have been flying at the rate of forty miles an hour. The magistrates, in testimony of their esteem for Mr. Lunardi, ordered the bells to be set a-ringing; and in about ten minutes after he was seen passing over Lanark. In the course of his journey, it is said, he met with a southerly current, along with which he was carried for about twelve minutes, but afterwards returned into his former course.

"It is impossible to describe the astonishment and admiration which Mr. Lunardi's ascent occasioned in this place. Indeed, the sight of the balloon, with Mr. Lunardi ascending along with it, was majestic and beautiful beyond description. To this, indeed, the gracefulness and genteel air of his person, with his easy intrepidity in the moment of ascent, contributed not a little. The most majestic part of the scene, indeed, was only visible to those in the churchyard, being in a great measure lost by the rest of the spectators who did not purchase tickets. The concourse of people was amazing. The Green, the tops of the houses, and all places where the sight could be had for nothing, were immensely crowded. Many were amazingly affected. Some shed tears, and some fainted; while others insisted that he was in compact with the Devil, and ought to be looked upon as a man reprobated by the Almighty.

"During the whole time that the balloon was filling, Baillie Brown attended, in the absence of the Lord Provost, and showed the greatest attention to Mr. Lunardi; and invited the principal persons, who were strangers, to dine with him in the Tontine, among whom was the Earl of Loudoun; and an Assembly was held in the evening.

"While the balloon was filling, the company were entertained by the musical band of the 27th Regiment, just now quartered here, who played a quick march as he went up. It is computed that there were upwards of 100,000 spectators assembled on this occasion, among whom were the greatest number of ladies ever seen in Glasgow, who were all very much interested in Mr. Lunardi's safety. As no accounts of his landing arrived on Thursday, many people began to fear some fatal accident, but their apprehensions were happily dispelled on Friday by the following letter to Colonel Ferguson:—

"'SIR, "Edinburgh, Friday Morning, 11 o'clock.

"'I have the honour to inform you, that at forty-two minutes after three o'clock on Wednesday evening, I touched the ground upon high hills, where, the wind being very fresh, the cable gave way, and I lost the great anchor and flag; the balloon being then lighter, ascended to a considerable height, and entirely lost sight of the earth. At fifty-five minutes after three I finally descended about two miles to the east of Alemoor, on the water of Ale, in Selkirkshire, and luckily met with Mr. and Mrs. Chisholm, who were riding on the mountains in their way home from a visit; and the lady took my place (being lighter) in the balloon, and went three miles in it.

"'Yesterday I was entertained by the gentlemen of Hawick, and the magistracy presented me with the freedom of the town.

"'This morning I reached Edinburgh, and to-morrow, at twelve o'clock at noon, I hope I shall have the honour to return you, *viva voce*, my sincere thanks, as I do with my pen, for all your kindness. I have the honour to be, &c.,

"'VINCENT LUNARDI.'

"According to his promise in this letter, Mr. Lunardi arrived with his balloon in this city, about half an hour after twelve o'clock on Saturday, and was entertained at dinner by the principal merchants, and yesterday by the officers of the 27th Regiment."

At five minutes before two by my watch I parted from the ground, but could not judge of the ascending power of the balloon, by reason of its waving with the wind, which was pretty high. Being therefore apprehensive of its again descending to the ground, I threw out two bags of sand in the very churchyard; after which I ascended with great velocity, and saluted the very respectable and brilliant company whom I had left, and the multitude of spectators who were assembled all round, by lowering my flag about sixty feet from the bottom of the gallery. It was now exactly two o'clock, when I entered a very thick but small cloud; on which I pulled the valve in order to descend below it, but the ascending power was too great, so that I continued to rise for some time longer.

On my coming again in sight of Glasgow, I found the compass had shifted $\frac{4}{3}\frac{}{6}$, the wind being N.W. I now passed through higher clouds, and at five minutes after two saw Hamilton, about two miles distant. The balloon had now lost its rising power, the rarefication of the air having expelled a great quantity out of it. I could see Lanark very well, but it was soon intercepted by a small and thick cloud. Finding myself descending, I threw out half a bag of sand; but that proving insufficient, I threw down the whole, on which the balloon stood motionless for about two minutes and then began to ascend at a good rate. I entered a thick cloud about three-quarters of a mile perpendicular, when I could neither see heaven nor earth, being in short involved in an ocean of clouds, which about a mile above me I perceived were of different and beautiful colours.

When involved in these clouds I dined, and having emptied one bottle of its contents by making a hole in its side, as I could not uncork it, I threw it down altogether, and heard it whistle as it descended for thirty-five seconds. The wind was now due south by the compass, and, being extremely fatigued and sleepy, having scarce rested three hours the preceding night, I lay down in the bottom of the gallery. That I might not, however, incur any danger by sleeping in this extraordinary situation, I fastened a small steelyard to a piece of rope, and this to the neck of the balloon, so that it was suspended about a foot distance from my face. The balloon was at this time keeping itself quite full by the rarefaction of air; and I was sure that when it began to descend it must become flaccid, and consequently longer, so that the steelyard would hit my face and awake me. Without the least apprehension, therefore, I fell asleep and enjoyed a comfortable nap for about twenty minutes, when the hook of the steelyard got hold of my chin, and I got up at once. I could now see the earth quite plain, and a serpentine river beneath me. I had no map, and the balloon was turning upon its axis, so that I could form no judgment of my situation; but turning upon my right I could perceive that the river below me was the Forth. It was then twelve minutes after three when I threw out half a bag of sand to keep me in a horizontal direction, and afterwards tried to descend on the other side of the river; but I saw with surprise that the balloon was again approaching to the river, when I dropped my pocket-book, and which appears to me has fallen about a mile to the north of the Forth. The balloon quickly crossed the river again, on which I threw away the remainder of the bag, but still the balloon rose but very little, and was involved in thick clouds on my coming to the S.E.

At twenty-five minutes after three the earth began to appear, and I found I was over huge hills, which I judged to be the Highlands. Being now descending very quick, I threw down the rest of my ballast, and rose to a considerable height, but still in sight of the earth. At thirty-eight minutes after three I was again descending, and saw the tops of the hills passing very quick, by which I judged that the wind was very high. 'I intended to come down betwixt some of these hills, as I could not see the end of them, and sleep there all night; and with this view let loose the big anchor about sixty feet from the gallery, and began to descend. As soon as the anchor got hold of the ground the cable gave way, and the anchor remaining in the ground, as well as the flag, &c., in all about eighteen pounds weight, the balloon rose again with great rapidity; and when above all the clouds I could perceive that they had the very same shape of the hills below. The water generated by the inflammable air came down converted into icicles. I passed horizontally through the clouds for about eight minutes: when I came in sight of the heathy hills again, I heard a voice call, "Lunardi, come down," quite plain, and I knew not who it was. I

saw at a distance sheep feeding, but could not see a human being, and I was greatly surprised to hear my name pronounced by any shepherd that might have been there with his sheep; and I could perceive no house, nor even huts in the neighbourhood. I called aloud several times through the hill, and after one-third of a minute or nineteen seconds I could hear the echo of my words returned as loud as they were pronounced; but *I* never had repeated "Lunardi come down," though I heard these words several times repeated, on which I answered through the trumpet, "Hallo! hallo!" with a great voice. I heard the words, "Lunardi, hallo!" repeated; and being now quite free from any interruption from clouds, I could see distinctly some people on horseback. At last I endeavoured to hasten my descent betwixt two hills where the balloon might be sheltered from the high wind; and, indeed, I came down as light as a feather. Two trembling shepherds came to me, an old man and a boy, whom I encouraged by calling to them, "My dear friends, come hither." They crossed the water and came up to me, and I gave them some sponge-bread that remained of my provisions; then a gentleman came, asking how I did, and at what time I set off from Glasgow; after a proper answer, I reached him with the balloon, and he mentioned the circumstances of meeting me as he was coming from a visit with his wife.

I asked the lady if she would get into the balloon, who hardly had pronounced, "I will," when she got into the gallery, and I went out desiring the shepherds to hold the ropes; I got upon her horse, and in company with her husband we followed her. After three good miles' riding, I saw that the balloon was very much waved; and the shepherds carried by it at a great rate, so that I thought proper to call the lady down, and it was with great difficulty and fatigue all of us together could succeed in emptying the balloon, which I committed to the shepherds' care, and went along with the gentleman and lady. At seven o'clock we arrived at their houses at Stretches, where I was very well entertained. I had a comfortable sleep, and next morning after breakfast the gentleman in whose house I was took me to Hawick, where I was received by the gentlemen and the magistrates, who very generously invited me to dinner with them, and presented me with the freedom of the town; soon after dinner, I got into a postchaise, travelled all night, and reached Edinburgh at six o'clock in the morning, when I wrote a letter to you with two enclosed, and despatched by an express to Glasgow, as I knew they would have been in anxiety. My course was S.E., then N., and then S.E.; the whole of my journey, 110 miles. The descent and place will be better described by the gentleman with whom I was so fortunate as to meet:—

EXTRACT OF A LETTER FROM GILBERT CHISHOLM, ESQ., STRETCHES, TO A FRIEND IN GLASGOW, NOVEMBER 23RD.

"Yesterday afternoon, about half an hour after three, as I was returning with Mrs. Chisholm from a visit to Sir James Nasmyth of Posso, Bart., my servant called out to me to observe a paper kite of most surprising magnitude and height. Turning my eyes to the place where the boy pointed, I perceived a body flying among the clouds which sometimes intercepted it from my sight. As it came near the ground I perceived it assume an oblong oval shape, somewhat like a sugar mould; but as I could perceive no string to hold it, nor any tail appended, I was convinced that it could be no kite, which indeed its extraordinary height had convinced me of before. As I knew that Mr. Lunardi was in the country, and intended a voyage from Glasgow this day, I began to suspect this must be his balloon, though I was yet unable to distinguish his car, and could scarce allow myself to think that he could be at such a distance from that city. As it still came nearer, however, I was at last convinced that it could be no other; and in about a quarter of an hour after I first saw him, he was got so near that I began to call out to him, 'Mr. Lunardi come down, come down!' This invitation I gave him the more earnestly, because if he had still gone on, he must have alighted in a very inconvenient place on account of the high wind. After repeated calls I had the good fortune to hear that he answered me through his speaking trumpet, though I could not distinctly hear what he said. At five minutes before four he alighted in a place very near the water of Ale, and so screened from the wind that the balloon stood quite upright, without inclining either to one side or another. Two shepherds who kept their sheep on the hill-side were so much astonished at the descent of the balloon with a human creature appended to it, that it was with difficulty I could persuade them that Mr. Lunardi was not some devil who would destroy them. At last by my earnest persuasion they ran down the hill, and, with some signs of fear, came up to Mr. Lunardi. My horse was so much frightened that I could scarce come within a gunshot, but Mrs. Chisholm, who rode a more peaceable beast, was allowed to come much nearer. The shepherds at my desire conveyed the balloon, and Mr. Lunardi along with it, over the water which separated us, which they effected with the greatest ease, the balloon yet rising from the ground with the slightest touch. After receiving our hearty congratulations, Mr. Lunardi asked Mrs. Chisholm if she would take his place in the aerial car, to which she replied by jumping

into it. She willingly would have had the balloon set at liberty, but, as the wind was very high, Mr. Lunardi judged this to be improper; for, as Mrs. Chisholm is considerably lighter, she must have ascended to a great height, and been conveyed to several miles' distance. The car, therefore, was held near the ground by the two shepherds. In this manner she was carried for about three miles, while the hills sheltered us from the wind; but then it became so violent, and the balloon waved so much, that she was obliged to alight. After this we assisted Mr. Lunardi in emptying his balloon, which was not accomplished without great difficulty on account of the high wind. After having the pleasure of Mr. Lunardi's company for the night, I had the honour of introducing him this day to the magistrates of Hawick, who, after having entertained him at dinner, presented him with the freedom of the city. Mrs. Chisholm is much pleased with her aerial journey, and still wishes that she had been set at liberty. As the report of Mr. Lunardi's landing has already spread to a considerable distance, our market of Hawick has been uncommonly thronged by multitudes of country people who have come to town in hopes of seeing this aerial hero."

I shall not have occasion to write to you again till I have taken my second flight from this place, as I cannot suppose that any accident will impede my enterprise, the apparatus remaining as I left it. This evening I intend to advertise my pocket-book, with two guineas reward to any person who may have found it; the original value is no more than twelve shillings, and it contains nothing but a paper of calculations and two letters, with my direction, one of which is your last, dated 26th October. My wishes are only to ascertain the place where it was found.

To-morrow I shall visit Paisley, where some beautiful manufactures are carried on. It is very astonishing that in France and Italy, where such a quantity of silk is produced, this branch of business should not be carried into the same degree of perfection as here! On Sunday I propose to return, and Monday is the day fixed for my ascension; soon after which, if no unlucky accident intervenes, you shall again hear from

Your affectionate and respectful

V. LUNARDI.

## LETTER VI.

MY EVER HONOURED FRIEND, Glasgow.

With additional pleasure I once more take up my pen to inform you of another aerial voyage. Happiness is doubly dear when thus communicated to a friend! What numberless blessings has the Art of Writing diffused! How many remarkable events has it perpetuated! How many nations has it taught to imitate the virtues of their ancestors! Without this, the dearest friends, when separated by distant countries, would be as dead to each other. By means of this noble discovery, we communicate our inmost thoughts to, and receive the kind sentiments of those we love and esteem, while intervening oceans roll their rude waves in vain; but let me not, while I praise, misuse the blessing, by wasting time in idle reflections, which I am convinced will not be half so interesting to your heart as the following particulars of my late journey:—

The auspicious morning being arrived, everything was ready by ten o'clock for beginning the operation. Exactly at eleven I was honoured with the attendance of the 27th Regiment, as on the former occasion, to support the civil power in keeping the peace and preserving regularity; though, thanks to God, no riot or disturbance ever happened at any of my experiments, the people being universally acquainted with my upright principles, and convinced of my intention to fulfil my promise in the most ample manner.

My two small casks, containing one-half of the ingredients for filling the balloon were instantly set to work; but as, at half an hour after eleven, there were but very few people assembled, I was advised by several respectable friends not to go on with the other until a greater number of spectators should arrive. The operation therefore went on but slowly, but at twelve I ordered the large cask to be set to work; by which means the balloon was inflated by half an hour after one.

During this process I could not help paying very particular attention to the different currents of wind, which indeed did alarm me very much. On this account I was obliged to decline the taking with me a young gentleman of this place, only twelve years of age, but of undaunted spirit, and who might have been a very agreeable companion to me, had the weather been mild; but the voyage at this time was very dangerous, as I myself very soon experienced. For the same reason I was obliged with regret to refuse the request of Captain Barns of the 27th Regiment, who had several times earnestly expressed to me his desire of taking an aerial voyage, and at this

time wished to have gone in my place. The answer I gave him at present, however, was, that "I would not, on this day, send up any friend of mine for all the gold in the world."

The wind in the lower regions had all this time been shifting almost every five minutes; and, in the space of an hour, had gone round three-fourths of the compass. The currents above were evidently W. and S.W., and E. and S.E. To avoid any danger from the church, I ordered the balloon to be carried to the end of the railing, and there I fastened the gallery to it. The wind was high, and tossed the balloon excessively: however I got into it, having all the instruments and provisions I wanted, there already. I desired several officious gentlemen to let it go; but you cannot conceive, my dear friend, the attachment of everybody here to me, how earnestly they wished to be near me, and offer me their services in the moment of ascension. I got up, however, about fifty feet from the ground, when the rope I had left loose for my servant to give me the rising power I wanted, when cleared of my friends below (which, however proved impossible) entangled a gentleman, who, I since understand, is a minister; and, with the greatest concern, I saw him dragged for a considerable way along the ground, till the rope was cut by my servant.

It was now near forty minutes after one o'clock, and my ascent was not very rapid, as I could see the people below for six minutes. This time I employed in securing the gallery to the balloon better than it had been done below; waving the flag, saluting the public. Soon after I lost sight of Glasgow. The wind below was S.E., and I took my course to N.W., so that I was kept in view by everybody. At forty-eight minutes after one, I was obliged to secure the compass and watch, and take hold of the upper hoop with both my hands, as the gallery was not only waving, but all to one side. The balloon being pressed by two contrary winds turned on its axis at least twelve times in ten seconds, and jumped up to a great height. It was now quite full, the inflammable air escaping very fast from the neck, and I opened the valve besides, when all at once it fell down for a quarter of a mile and there became stationary; it was now two-thirds full, and the silk below sticking together, and driven with the violence of the wind, made a terrible and hideous noise, keeping the valve constantly open, so that I could hear the inflammable air whistle in escaping.

At fifty-two minutes after one o'clock the balloon was prodigiously inclined to one side, and the gallery almost overturned, so that I was exceedingly alarmed, being obliged to hold the upper hoop, where the net terminated, fast with both my hands. I then found myself attacked by two contrary winds; the balloon turned with great velocity upon its axis, and jumped up about one hundred feet; then began to descend with such rapidity that I could see the clouds below approached me very fast, and some passing very rapidly. When the gallery began to keep itself steady again, I endeavoured to put out both my anchors; the smallest fastened to a very long rope, and the biggest to a shorter one: I threw down two bottles I had full of water, and all the ballast at once, which did indeed check the rapidity of my descent, but could not give the balloon levity enough to rise again; the small anchor got hold of the earth, as well as the large one; I then suspended myself to the upper part of the gallery, letting the bottom of it receive the blow from the earth, which broke it in two parts, and I got a very violent shock, but happily am not hurt. It was just two o'clock when I descended. In the place where I alighted there was but very little wind, and the balloon stood perpendicular. Both the anchors having got hold of the ground, I could have come out of the car and done everything myself without any assistance; but I was immediately surrounded by a great many, who were all very ready to offer me their services, and did as much as was in their power to assist me, and take care even of the smallest thing.

The Rev. Mr. Lapsley, the minister of the parish in which I descended, was the first gentleman who reached me, and he very politely sent his servant to take care of the balloon, &c., and expressed his joy in having accidentally met with such an extraordinary piece of good fortune in meeting me. While I was going towards his house, accompanied by the whole multitude of people collected on that spot, we saw at a distance a gentleman advancing very fast: this was Sir Alexander Stirling; who invited me and the minister to his house, where we were well entertained. But it is beyond the power of my pen to paint to you the happiness of this old gentleman in having me at his house, in such an extraordinary way, and his expressions on the occasion.

Mr. Lapsley agreeably amused me while at dinner with a conversation upon aerostatic experiments. He seems to be a very intelligent gentleman, and has written a letter to a friend of his in Glasgow, a copy of which I enclose for your inspection, and which will enable you to form some judgment of his sensibility.

At seven o'clock in the evening, a chaise being ready, I took leave of Sir Alexander, and was accompanied by Mr. Lapsley to Glasgow. I went immediately to the play, where I was received with great applause.

This day I was entertained at the Saracen's Head with a very splendid dinner by Provost French, Mr. Ingram, and several of the best citizens, where I was presented with the diploma, and made Knight of the Cape. Indeed, I am very much caressed through all Scotland; therefore, if I be attached to this nation, you cannot think it any wonder.

I reckon it a very fortunate circumstance that in this descent, as well as a former one, I should meet with a minister, young, sensible, and accomplished; such is Mr. Lapsley. I shall transcribe a letter from him to one of his friends: his attention to the various occurrences being more exact than what I could possibly pay, it has enabled him to observe, recollect, and mark down the most minute circumstances.

COPY OF A LETTER FROM THE REV. JAMES LAPSLEY TO A FRIEND IN GLASGOW.

"DEAR SIR, "Manse of Campsie, Dec. 6.

"Although you and my friends in Glasgow have had the advantage in seeing Mr. Lunardi ascend twice into the atmosphere, I will not suffer you now to boast too much of your good fortune, for he has done me the honour of paying me a visit in my own parish. I saw him descend from his car, and was pleased with the remarks of the villagers upon his descent. The people of Campsie were too bold to be afraid of him; and they are above disguising what their feelings lead them to express.

"Yesterday afternoon, whilst I was walking through my parish, visiting the sick, and rather inclined to be pensive from reflecting upon the scenes of distress to which I had been witness, my attention was suddenly arrested by a confused humming noise, which seemed all at once to spring out of the earth towards the south; but as my view from that quarter was intercepted by a clump of trees, I walked on, and for two minutes I had it not in my power to inquire from what cause it proceeded.

"An old woman at that moment joined me, hearing the noise at the same time, took some pains to convince me that it was the buzz of those spirits and elves who before Christmas Eve hold their meetings in sequestered dales, lamenting their lost power.

"You will easily believe that such a wayward fancy was not then agreeable to my present humour. I left her and hastened to a rising ground, when I now heard distinctly several people shouting aloud, 'Yonder he comes!' Turning round I beheld the balloon sailing majestically almost over my head. Mr. Lunardi was then standing in his car and waving his banner. His distance from the earth seemed to be about 400 yards. The people were coming from all quarters: their acclamations were every moment waxing louder and louder, and the farmers, in imitation of Mr. Chisholm, were shouting vehemently, 'Lunardi, come down!' And I, along with the rest, invited him to descend.

"I am rather inclined, however, to think that he did not hear me, owing to the whistling of the wind, it being very violent during the whole of his excursion. However, as he had resolved not to go far, we were indulged in our request; for, exactly at two o'clock, he descended at Easter Mockroft, on the banks of the Glassart on the estate of Sir Archibald Edmonstone, of Dunreath, in the parish of Campsie, nine English miles and a half N.N.E. of Glasgow.

"When I saw the balloon first, which was about two minutes and a half before two o'clock, it appeared to be very much agitated, turning round its axis, while it was floating through clouds of air, and the day being hazy, it resembled very much in appearance the full moon, seen through a darkened glass labouring in an eclipse. Sometimes it appeared of an ash, sometimes of a copper colour; sometimes even darker, owing to the different shades reflected from the Campsie Fells. About half a minute, however, before he alighted, the sun came out behind a cloud and shone directly upon the balloon: every colour became distinctly seen, the various stripes of the flag became vivid, his regimentals and the decorations of the car affording a varied and most beautiful spectacle, according to the play of the different rays of the sun, and as my view on the north was bounded by the Campsie Fells, whose tops were then covered with blue mist, the balloon appeared, as it were, to come out of the mist and descend in a sunbeam.

"As the balloon was perfectly unexpected by me, and as at the very first it appeared in all its grandeur, I confess, without hesitation, that the pleasure I had in seeing it sailing through the clouds, and descending in our sequestered vale, was a pleasure mixed with some degree of pain. I laboured, as it were, under the grandeur of the object, and strove to compare it to something I had seen; but I failed. However, a young gentleman happening to

come up to me at that moment, whose imagination was not so overpowered, asked me if I thought it did not resemble the description given by Milton:

> Nigh at hand
> Hung high with diamonds flaming, and with gold:
> Thither came Uriel, gliding through th' even
> On a sunbeam, swift, as a shooting star
> In autumn thwarts the night.

I told the gentleman that this description was but a conceit in Milton; not ill-pleased, however, to find that we had got some likeness, though fanciful, to compare it to.

"As he had descended to within half a mile of where I stood, I immediately hastened to welcome Mr. Lunardi, and to give him all the assistance in my power. The whole country seemed to be alive, running to him with the same kind intention; and I perceived with pleasure that curiosity was a principle not confined alone to the breasts of the higher born and better educated class of men; for, in passing a little cottage, I heard a weaver expressing the most vehement desire to see this great sight, and crying to his wife to 'take care of the bairns.' I believe, however, that she at this time forgot that ever she had promised him obedience, and set out, repeating his commands to the servant, who in her turn exclaimed with rage that 'she wondered what people imagined servants were made of. Let those who got bairns take care of them; for, by her faith, she would both see and touch Lunardi with the best of them;' and threw the child from her. Perhaps upon another occasion we might have taken time to tell her that she expressed herself too strongly; but yesterday everything was her friend.

"During my going from the rising ground where I first saw it to the vale where it alighted, I sometimes lost sight of the car, by the gentle swells which intervened, but never lost sight of the balloon; and as it was suspended some yards from the ground, betwixt the darkness of the day and the blue mist of the mountains, under whose shade it was, it had the appearance of an object arising out of the sea, resembling the sun when he makes his first appearance in a spring morning out of a thick fog. Before I arrived it assumed a new shape—that of a pear, or inverted cone. Mr. Lunardi then standing in his car, about four feet from the ground, some people assisting him to get out and others holding the rope in order to prevent him from being dragged along by the strength of the balloon, which was hovering above him.

"It was about six minutes after two when I got up. More than forty people were before me. A multitude now assembled from every quarter. The shepherd forsook his flock, the farmer left his plough, and the traveller his journey, so that in less than a quarter of an hour there were many hundreds gazing with astonishment at the daring adventurer. Everybody was pleased, and everybody wished to lend their aid. Mr. Lunardi hardly had occasion to ask for assistance, nor I to encourage them to give it. At half an hour after two the balloon was emptied, and the netting, basket, and other apparatus packed up and all ready to march off the field.

"Persons from different parishes now wished each to have the honour of his going to their particular village; however, as I had asked him to do me the favour of taking some refreshment at the Manse of Campsie, my parishioners were not then to be gainsaid; and in a sort of triumph we began our journey, when Sir Alexander Stirling, of Glorat, one of my principal heritors, came running up, welcoming Mr. Lunardi and insisting on his going to Glorat, which invitation we accepted of as being nearer than the Manse, and we set out for that gentleman's house in the following order:—

"A little pretty boy carrying the banner; next came Mr. Lunardi dressed in his regimentals, attended by the Baronet and myself. We were followed by a stout fellow carrying the anchor, then by four youths supporting the car, and then by six stout men bearing the balloon, escorted by a vast number of people of all denominations. We had not, indeed, the ringing of bells, but we were cheered by the hearty acclamations and repeated huzzas of many hundreds of the villagers expressing their joy at the unexpected visit.

"In going to the Baronet's we had to cross over the bridge of Glassart, where about thirty young blooming lasses had ranged themselves on each side to have a sight of this comely adventurer. All of them appeared well pleased. There was one, however, not the least lovely of the number, whose sensibility led her to express herself more strongly than the rest: 'How pretty he is! I wish I had been with him.' Mr. Lunardi was too attentive to let slip an opportunity to say a civil thing to our fair countrywoman; he patted her cheek, whispering, 'My angel, and so do I.' Whatever things this young woman may be disposed to forget, I will engage for it she will never forget the looks she received from her companions at that instant, nor the sensations she felt when her cheek was pressed by the hand of this bold Italian.

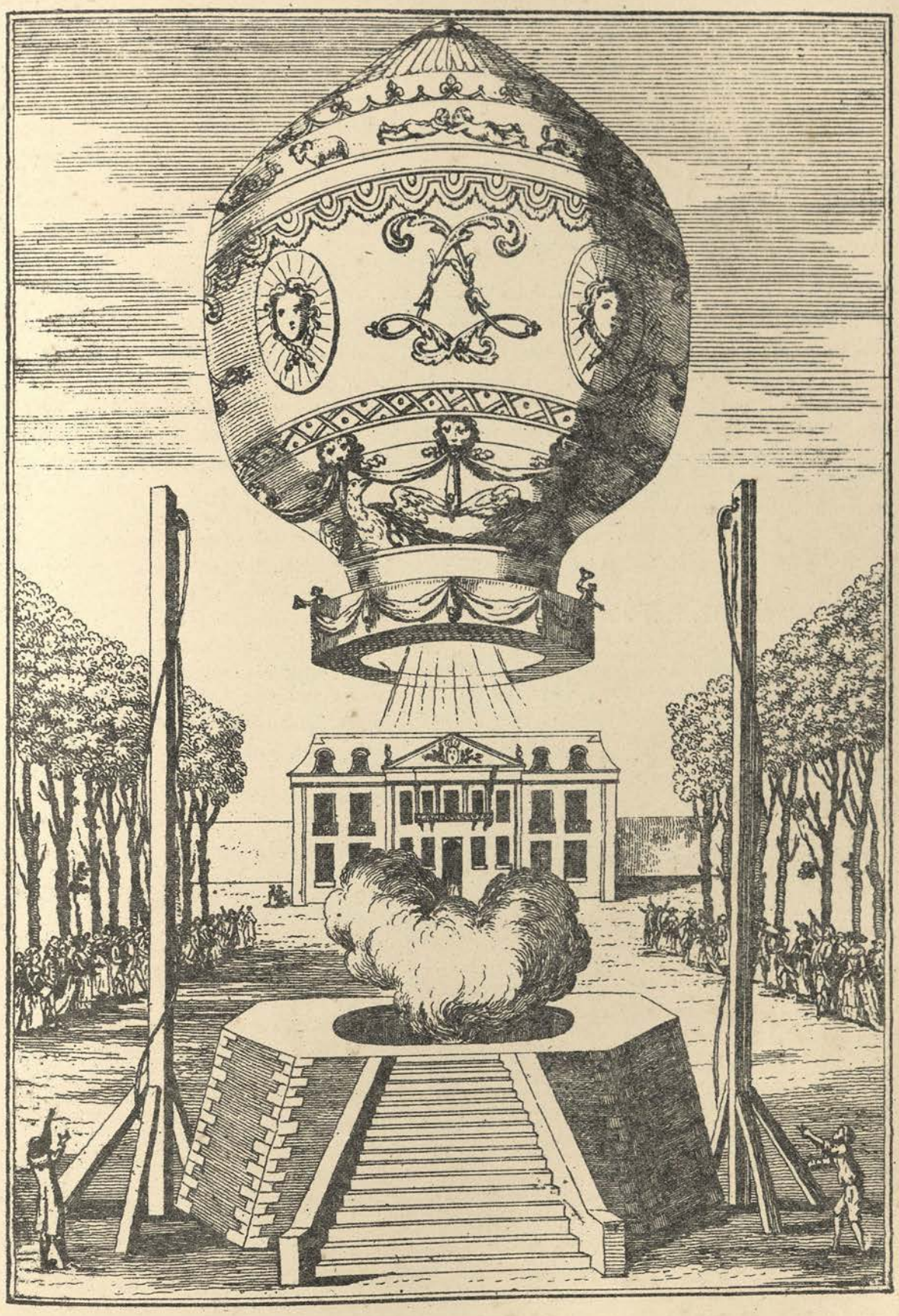

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director.*

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"We had now arrived within a few hundred yards of the house of Glorat: we stopped at a little hamlet, pointing out some prospects to our new visitor, when I perceived an old woman, whose frailties would not permit her to run with the multitude, eagerly looking at him. She first examined his flag, then she touched his clothes and his body, and having heard him speak, rubbing her eyes, she said, 'I am sure there is nae Glammary here; but oh! Sirs, it's a fair pity he should be a Papist.' She was immediately checked by an old grey-headed man, who in the pride of his heart exclaimed, 'Be he Papist, or be he Pagan, fair fa' him, tho' a' the kirk were here, and Lord George at their head, I would drink his health; and here's to him.' Then addressing himself to me, 'Oh! Sir, I am an auld man, I am aulder than the Union; I have seen mony things, but the like of this I never saw. I have seen Marr's year, and the Highlandmen's raid; and about twelve years syne I gaed o'er by yonder (pointing to the canal) to see ships sailing thro' dry land; but the like of this I never saw. Dinna ye think the world will soon be at an end?'

"We arrived at Glorat at three o'clock, where we dined, and having drank a few glasses of wine and coffee, a post-chaise was got; and, as I was obliged to come to Glasgow that night upon business, I begged to accompany him. We set out from Glorat at half an hour after six, and arrived in Glasgow a little before eight. Mr. Lunardi alighted at the Tontine amidst the huzzas of a vast concourse of people, who had assembled anxious to express their joy at his arrival.

"Having promised his friends before he set out in his aerial excursion that he would certainly, if possible, be at the play that night, he immediately, therefore, got dressed, went to the house about nine, and was again received by the acclamations of the young, the gay, and the fair.

"P.S.—As I was obliged to leave the town without seeing you, I took the liberty of writing to you my observations on his descent, and the varied sentiments of curiosity and surprise which the spectators expressed. Perhaps it may contribute to your amusement in an idle hour."

To-morrow morning, about four o'clock, I shall set out for Edinburgh, where I know they are all in expectation of seeing a second excursion; and, if possible, I mean to ascend from Heriot's Garden on Monday, the 19th instant.

Adieu! my honoured friend. Give my best love to my dear sisters, and believe me to be, with the most sincere affection,

Truly yours,

V. LUNARDI.

## LETTER VII.

MY DEAREST FRIEND, Edinburgh, December 11, 1785.

At eleven o'clock this forenoon I reached Edinburgh, where, with other letters, I found two of yours, one dated the 2nd and the other the 7th November. I am truly sensible of the many obligations you have heaped upon our family: we all look upon you as a second father, and give me leave to pay my most grateful thanks for the kind part you have taken in my sister Margaret's behalf. I know she would look upon your advice as that of an indulgent parent; but let me earnestly entreat that you will not in any degree bias her inclinations. In an affair of such moment she cannot be too cautious; and I fear her prospects of happiness would be sadly clouded should she marry a gentleman whose advanced years must render him an unfit companion for a girl of three-and-twenty. Their tempers, their dispositions, must be widely different! Age can ill accord with the lively sallies of youth, or youth accommodate itself to the gravity of age. I am proud to acknowledge the honour this match might reflect on our family; but, as Margaret declares she will act according to my advice, I beg you will tell her that, as a brother and a friend, I think that wealth, titles, and grandeur would be poor, very poor compensations, for the sacrifice of her affections.

In your second letter I found enclosed one of introduction to your old respectable friend; but I am extremely sorry to acquaint you that his death was announced in an Edinburgh paper of the 16th November.

I propose to ascend on Monday, the 19th instant, with two balloons, the common one and another of ten feet diameter, which is already made, under my direction, by the girls of the Merchant's Hospital. It is to be 550 feet higher than that by which I am supported, in order to ascertain the different currents of air.

The same girls are also constructing another balloon, which, though without any valve, is so contrived as not to burst when the rarefaction of the air takes place, even though it should ascend with 100 lbs. of rising power. It

is composed of 100 yards of fine Persian silk, in stripes of pink, green, straw-colour, and white, and is designed as a model of a large one which I mean to construct for a long journey.

Till I return from my next flight, once more adieu, and believe me to be

Sincerely yours,

V. LUNARDI.

## LETTER VIII.

MY REVERED GUARDIAN, Edinburgh, December 24, 1785.

My last letter acquainted you that I proposed ascending with two balloons—an experiment which, however interesting, I had not the good fortune to try.

The morning was tolerably favourable, but as the day advanced it became thick and foggy, attended with small rain. Sensible that under these circumstances I could not be visible for more than two or three minutes, and that it must be very inconvenient for the ladies to remain in an unsheltered place like that from which I was to ascend, after some deliberation, I resolved to delay the experiment to some more favourable day. At this time I obtained a promise from his Excellency General Mackay that a gun should be fired from the Castle at ten o'clock in the morning of that day, as a certain signal to the public; on which I ordered handbills to be distributed signifying my intentions.

In the afternoon I attempted to fill the small balloon with a new apparatus of my own invention, which succeeded beyond expectation. All this time my large machine was kept inflated with atmospheric air at the Register Office, where a vast concourse of people assembled, and some gentlemen, friends to my undertaking, stayed to learn the opinions of the people in general respecting my conduct. I am happy to inform you that all the ladies approved it, and only a very few gentlemen expressed their dissatisfaction; yet even this mark of disapprobation, trifling as it was, when reported to me wrung my very heart, and I determined, if the weather proved tolerable, nothing should prevent my utmost efforts being exerted to ascend the day following.

On Tuesday, about seven o'clock, I arose, and perceiving it to be a fine morning, without noticing the direction of the wind, I ordered my servants to carry everything necessary for my experiment to Heriot's Garden, and wrote a note to the Governor of the Castle, begging to be favoured with the attendance of the military and the firing of a gun, as had been promised. Lord Elphinstone seemed greatly surprised at receiving such a card, as the wind was too much from the west, and therefore very obligingly sent me word that he was ready to do everything in his power for my service, but thought the undertaking too dangerous. My resolution, however, was unalterable, and his Lordship at last did me the honour to acquiesce in my wishes; on which I went to the Garden and prepared for my ascension.

A little after eleven o'clock I began to fill the balloon with half the apparatus, and in ten minutes it could support itself; but at this time there was not much company assembled. They said the gun was scarcely heard, and, as the wind still continued westerly, people of sense could not imagine that I meant to venture. I now sent to General Mackay, requesting the favour that another gun might be fired: this his Excellency readily granted; after which, the flag being hoisted on Heriot's Hospital, I set the remainder of the apparatus to work, and the number of spectators increased very fast.

During the process I secured several bladders and pieces of cork round the car. The general question being, "Whether I really intended to go up?" I made answer that it was impossible to prevent my dropping into the sea, but I was confident some boat would arrive in time to my assistance.

Dressed in the uniform of the Scots Royal Archers, five minutes before one o'clock I rose majestically, though not with so great a degree of velocity as the former time. The wind was south-west. After saluting the spectators, I fastened some of the strings which had been left loose, and began to untwist the rope of the little anchor. In three minutes from the time of leaving the ground I perceived myself perpendicularly over the Forth.

Exactly at one o'clock the balloon turned thrice round upon its axis, and was completely full; the barometer at 21 in., the thermometer at 38°, wind south-west by west, and I was moving very slowly, with the most delightful scenery beneath me.

Half after one the balloon continued much in the same state, and the barometer had only fallen two-tenths. I was going horizontally to the north-east, and saw a boat rowing towards Musselburgh. I threw down a piece of cake about half a pound weight, but do not know whether it fell into the boat.

Fifty minutes after one the wind was due west, and I therefore resolved to attempt landing on the point of

Archer Field. For this purpose I let go my small anchor about six hundred feet below my car, and began to descend; but, finding that I came down with too much rapidity, and had no ballast nor the large anchor, I shut the valve and threw down a bottle full of water, when about 2000 feet from the ground; by which means I passed over the point of land and came again upon the water. At this elevation the thermometer fell to 31°. I fastened my uniform great-coat, my hat, and some other things to the upper hoop, that they might not be injured by my falling into the sea.

At five minutes after two I touched the surface of the water, not farther than a mile and a half from the rocks of Fidra and Lamb; but as the wind was pretty strong, and the balloon acted like a large sail upon my basket, I made way very fast, the water dashing against me and sparkling like silver. I turned round, and could see no boat whatever; but, when about two miles and a half from the south shore, could distinguish three ships, under sail, near Anstruther or Kilrenny, and therefore was under no apprehensions, as my course was towards them and the island of May.

The balloon was much agitated by the wind and sometimes turned round, so that I was frequently tossed into the water as high as my breast. When about five miles from North Berwick I perceived a black spot, appearing and disappearing according to the rising and falling of the waves, directing its course from the Bass. On paying more attention, I saw plainly that it was a boat; but, as I was going with great rapidity, I quickly passed their parallel, and then, as they had gained the wind, and made use of their sails as well as oars, I assured myself they would quickly reach me, and began to wave the flag as a signal that I had seen them.

The nearer I approached the ocean the wind grew brisker, and I began to be in doubt whether to cut away the balloon or not; but, after mature deliberation, I resolved to keep it; for, as darkness now began to draw nigh, I should have been too small an object without it to be viewed at any distance, being at this time breast-high in the water.

As soon as the boat came up I threw out a strong rope, desiring the fishermen to make it fast; but the moment I got on board they let it go, and the balloon was instantaneously out of sight! And now my situation was not the most comfortable: heavy with remaining so long in the water, my hands lacerated with clinging to the hoop, and every limb wearied, I sat down, as well as I was able, in a boat full of fish, while the sharpness of the air contributed not a little to heighten my distress.

A King's boat soon came up, and the gentlemen very politely invited me on board; but I was obliged to decline this polite offer, that I might show my gratitude to the people who had taken me up. I landed on Archer Field about five o'clock, where I found Mr. Nisbet's servant waiting to conduct me to his master's house. I ran thither as fast as possible, in order to make my blood circulate more freely, for the cold had been so intense as to freeze my clothes.

Mr. Nisbet was gone to North Berwick, and his charming lady had prepared for my arrival as if she had been sensible that I should land near their house.

When Mr. Nisbet returned, he could not refrain from personally assisting me to change my dress, when, being quite refreshed, I went down to dinner and paid my compliments to the elegant Mrs. Nisbet. The British women who fill the higher ranks of life may, I think, be pronounced the handsomest in Europe; but the case is different with the lower class. This contrast is very striking in Scotland, where the country girls and those in servile stations continually go barefooted, which practice is also common in our own country; yet the Italian peasantry, with equal strength, enjoy a far superior freshness of complexion. The reason of this I take to be that the Scotch women are often obliged to walk in the wet, their streets and lanes being seldom free from that inconvenience, while ours tread a drier earth, and for any occasional damp have wooden shoes.

I conversed with my hospitable landlord most part of the evening: he is a most ingenious gentleman and has resided several years in Italy. Our acquaintance first commenced at Kelso; where, while others were dancing, we had a long conversation relative to Rome, Naples, &c. Though at that time I entertained the highest opinion of his understanding, yet, as I had not then the pleasure of knowing his name, it was some hours before I could recollect where or when I had enjoyed his company, though both his person and manner were so strongly impressed on my memory as to appear perfectly familiar.

I arose at nine the next morning and went to breakfast: after which Mr. Nisbet obliged me with a sight of his garden, which may rival the most elegant in Italy. Though now the depth of winter, the well-stored hothouses bloomed with all the beauties of contrasted seasons and of various climes; but in the summer, when spring has

poured out his vast profusion, and the simple charms of Nature aid and are aided by the elegancies of art, what a terrestrial paradise must this be! I shall be strongly tempted to pay it a visit, and, with the friendly, hospitable owner, stroll through these regions of pleasure.

These haunts where the Muses delighted might rove,
And Nature, all lovely, would teach us to love;
Where blasts from the North might forget to be rude;
And care on our joys should not dare to intrude.

At twelve o'clock Sir David Kinloch, with his son and daughter, accompanied by Major Mackay, came and invited me to his house, where I spent a very happy afternoon, and in the morning set off with Major Mackay for Edinburgh, where I found the generous inhabitants had opened a subscription to enable me to make another balloon; but, as I am confident mine will be found, I propose, with the most grateful thanks, to decline this obligation; those already conferred upon me are sufficient to lay a weight upon the feeling heart.

Before my arrival in Scotland several attempts had been made to launch a large fire-balloon, but all without success. The poor man who should have gone up, how I commiserate his situation! Judge of his sensibility and misfortunes by the enclosed papers. Do not wrong me so much as to suppose that I have been contented with sitting down idly to drop the unavailing tear over them. I have seen the man; I have offered the voice of consolation to alleviate his distresses, and dictates of humanity have been obeyed as far as lay in my power. Alas, how circumscribed that power! It is only upon occasions like these that I lament its narrow bounds. Adieu! approve and join the prayer that the unfortunate may ever find a sympathising friend in

Your cordially affectionate

VINCENT LUNARDI.

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## TO MR. LUNARDI, ON HIS SUCCESSFUL AERIAL VOYAGES FROM EDINBURGH, KELSO, AND GLASGOW. BY J. TYTLER.

ETHEREAL trav'ller, welcome from the skies!
Welcome to earth, to feast our longing eyes!
Once more we, trembling, for thine absence mourn'd;
Once more we bless thee from high Heav'n return'd.
Bodotria greets thee from his utmost bounds,
From Glotta's banks incessant praise resounds;
The winding Avon views thee in the sky,
T' enhance thy fame the tinkling murmurs fly.
Applauses loud the lofty forests fill;
Admiring echoes ring from hill to hill.
With gen'rous warmth each honest bosom glows,
Each honest heart, exulting, praise bestows.
Fair Tweed beholds thee gliding o'er his plains;
Thy name resounds from all his tuneful swains;
Thy rising honours Fame's loud trumpet spreads
Where Grampian mountains rear their lofty heads;
Beyond the space of old distain'd with gore,
Where dreadful Rome her arms unconquer'd bore;
Where, mourning, o'er th' ensanguin'd slippery field,
Sad Scotia wept her bravest heroes kill'd.
Ev'n frozen Thule shall thy fame proclaim,
From all her barren rocks resound thy name!

But say, what Pow'r, O fav'rite of the sky,
(Though on ethereal pinions taught to fly,)
To thy bold breast such dauntless courage gave,
When far below appear'd the wat'ry grave;
When tow'ring through vast heaven's tremendous height,
The Sea's grim horrors first appall'd thy sight;
When slow descending from the distant skies
The boundless Ocean claim'd thee for his prize?
Or who could guide thee o'er the vast profound,
Where blust'ring winds from dashing waves resound,
Untouch'd, unhurt, again to earth restore,
And safely lead thee to glad Scotia's shore?
'Twas He whose Pow'r the stormy clouds can bind,
Who guides the tempest and directs the wind;
'Twas He who led thee through the trackless air,
And, though thou saw'st not, He was surely there.
Th' aerial stream sent by His high command
Restor'd thee safely to the joyful land.
Superior praise to thee His pow'r consign'd,
On thee bestow'd thy matchless strength of mind;
To distant ages gave thy deathless fame;
To future bards He gave Lunardi's name.

But how shall I to sing thy praise aspire?
What Muse shall fill me with poetic fire?
Shall I address the fabled pow'rs above,
And boast that Phœbus will my vows approve?
No, let me to some distant region fly,
If such there be, beneath another sky;
Go, court the horrors of wild Zembla's coast,
Or, in the dark Cimmerian Regions lost,
In abject exile hide my wretched head,
Or fly for refuge to the silent dead!
On me, alas! the adverse heav'ns have lour'd,
Relentless fortune hath her vengeance pour'd;
Scarce rais'd from earth, and but to sink more lo
And more severe to feel the fatal blow,
The Whirlwind, or black Eurus stops my way,
Or angry Zephyrus commands my stay;

Confusion, Discord, all my ways oppose,
And *friends* misguided prove my greatest foes.
Yet though I mourn my fav'rite wishes crost,
My hopes, by Fortune or Misconduct lost,
My constant mind o'er each mischance prevails,
My feeble pow'r yet adverse fate assails;
Once more I try on wings of wind to rise,
Like you to ride in triumph through the skies;
I try in vain;—the bellowing thunder roars,
The gath'ring tempest scowls along the shores;
Fierce Notus urges on his furious course,
And sweeps along with stern resistless force.
Lost are my wishes, lost is all my care,
And all my projects flutter in the air.*
Proscrib'd, despis'd, ah, whither shall I turn?
In silent solitude for ever mourn?
Or shall my hand, urg'd on by black despair,
In monst'rous guilt at once efface my care?
With my own blood seal ruin and disgrace,
And brave the great Creator to his face?
——Forbid it Heav'n! let Fortune rather shed
Her yet remaining vengeance on my head;
A wretched object let me rather lie
To ev'ry miscreant as he passes by;
In dull Oblivion let me rather sleep,
As vile, unnotic'd, useless insects creep;
Let fierce Reproach insulting ever wound,
Envenom'd shafts of malice fly around,
In wretched darkness be my poor abode,
By men abandon'd, and oppos'd by God!

But while in hopeless exile thus I mourn,
My mind with desperate gloomy passions torn,
I see thee graceful and majestic rise,
Mount on the winds, and triumph in the skies;
Till envious clouds conceal thee from our view,
And eager Vision can no more pursue.
At once Ambition points to Fame the way,
Dissolving clouds of cold Despair decay;
Celestial Hope again her influence show'rs,
Again my soul calls forth her latent pow'rs.
To follow thee my inmost bosom burns,
Tumultuous thoughts possess the mind by turns;
Unconquer'd yet, with thee my fancy flies,
My soul aspiring yet explores the skies.
Impatient now I long the ground to spurn,
Like thee to rise, in *fiery* chariot borne;
To leave the earth, to leave the clouds behind,
To mount on pinions of the rapid wind;
Beyond the reach of vulgar ken to soar,
Beyond the space where blust'ring tempests roar,
To see bright Phœbus pour unsullied day,
While through wide heav'n he darts his cloudless ray;
To see the splendours of the Moon arise,
And all the glories of the spangled skies.
Not as through Vapour's medium dull we view,
The clouded concave of Ethereal blue;
But as from Ætna, or the Alpine Hills,
Th' exalted mind the glorious prospect fills;
Where Galaxy in purest flame appears,
And wond'rous glories clothe the shining stars;

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* To understand these lines relating to my own misfortunes, it is necessary to give a short history of the Edinburgh Fire-Balloon. The machine, from its size, was certainly capable of performing everything expected from it, provided a sheltered place for raising it could have been obtained, and a proper degree of heat applied. The former, however, could not be had. The place where it was first raised was exposed to the west wind, which blew so strongly during the first week of August (the week of the Leith Races) that it could not be inflated until the Friday evening, when the gallery took fire, and some of the chains suspending the stove broke, which prevented any further attempt at that time. An interval of calm intervened on the Saturday evening, which was made use of to inflate the balloon. The gallery was in little better condition than the preceding evening; nevertheless I was about to step into it, when a sudden gust of whirlwind, common in this country in unsettled showery weather, expelled the rarefied air out of the balloon, and otherwise so much damaged it, that no further attempts could be made that night. By continual pulling and tearing about, attempting to inflate it when it was evidently impossible, and other injudicious proceedings (for which I do not think myself accountable, because I was not at liberty), the paper with which the balloon was lined had been so much damaged, that I now thought proper to take it out altogether, and cover the cloth with some kind of varnish, which might be less apt to receive damage from rough usage. This was done; but as a proper composition could not be afforded, the balloon, though capable of making one or two experiments, was yet far from being able to endure the fatigue it had to undergo. There was now no gallery, and the stove with which it was to be heated, being very little short of three hundred pounds weight, was incapable of being taken up; or, at any rate, without a gallery no stove could be taken. I now came to the resolution of suffering myself to be projected into the air by inflating the balloon to the utmost, and being appended to it without any furnace, like a log or piece of ballast. You will easily see that this was the resolution of a *madman*, and which nothing but my desperate situation could excuse. A fire-balloon in this situation is a mere projectile, and must undoubtedly come to the ground with the same velocity that it ascends from it, unless the person has a considerable quantity of ballast to break his fall as he descends by throwing it out. Of this it were easy to give a demonstration, if necessary; but it is not worth while, as you will at first perceive it to be true. Having, therefore, obtained one fine and favourable morning, the balloon, new varnished, and very tight, was exposed to a very strong heat for near an hour. It was inflated to such a degree, that I am persuaded its power of ascension must have been upwards of half a ton, as a number of people could with great difficulty keep it near the ground. With this monstrous power I suffered myself to be projected upwards, seated in one of the small baskets in which earthenware is carried, without ballast, or indeed without thinking of any. The balloon set off from the ground with the swiftness of an arrow, but could not ascend more than a few feet, when it was stopped by a rope belonging to the mast which held it up during the time of inflation. This broke its force very considerably; and even when freed from this, it flew with such rapidity that several of the spectators, terrified at the unusual sight, endeavoured to drag it downwards till the rope was forced from their hands. Thus my career was stopped, and I arose only a very small way, some say three hundred and fifty feet, others five hundred. For my own part, I had scarce time to taste the pleasures of an aerial journey; and during the little time I was in the air, I amused myself with looking at the spectators running about in confusion below. My reception from the ground was much more rude than I expected, and though insufficient to *hurt*, was enough to *warn* me to proceed no more in this way. However, by particular desire, I did take another *leap* of the same kind a few days after, but with much more caution; for I would not now suffer the balloon to be so much inflated, and desired my assistants to break its power as I ascended, that I might only pass over the adjacent trees and houses. Even then the power of the balloon was very great, so that it overturned five or six people who attempted to stop it; and, indeed, from these two experiments, I am induced to believe, that the power of large fire-balloons is much greater than is commonly supposed, and that the received theories concerning them are erroneous.

The moons of Jove, without a tube to view,
And endless beauties of the heav'ns pursue;
See Northern Lights in flashing glory rise,
And paint their colours of a thousand dyes;
To view bright meteors like the Sun appear,
And stream their glories through the empyreal air;
To try the strong electric Ether's pow'r,
T' explore the sources of the gladd'ning show'r;
Through treasures of the direful hail to fly,
And view the dread artillery of the sky;
Laugh at the labours of the sons of care,
And see them move like *atoms* as they are.
Transporting thought! I'll yet with Fate contend,
Nor shall my hope to dire misfortune bend;
Let lying Slander trumpet through the crowd,
Accursed Hate proclaim each fault aloud,
Detraction, Malice, and blue Envy burn,
And each *misfortune* to *misconduct* turn;
My mind unmov'd fair Science shall pursue;
My hopes, my wishes, ever follow you;
Each error past, Experience shall correct,
And careful Prudence every step direct;
Till rais'd from earth, I to the skies aspire,
Conducted safely by devouring fire;
To future ages then consign my name,
And stand thy Brother in Records of Fame.

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On the Continent, during the following years, Blanchard ascended from Brussels, Berlin, Douai, Hamburg, Liége, Valenciennes, Nancy, Strasburg, Nuremberg, Basle, Mulhouse, Metz, and Warsaw. It is worth notice that Alpine and other mountain ascents were unattempted till aerostation had given a stimulus to the exploration of the higher regions of our atmosphere; and it was not till the 7th August, 1786, that MM. Jacques Balmat and Paccard, were the first to reach the summit of Mont Blanc. Their steps were followed the next year by Professor de Saussure and Colonel Beaufoy. The French revolution now caused further experiments to cease; and, before it had subsided, aerostation, far from furthering the peaceable and intimate association of nations, that at its invention was anticipated, was now employed as an accessory of warfare, and a military aerostatic corps was formed in 1793, which proved of use, as will be hereafter told, at the battle of Fleurus.

Napoleon also used balloons for impressing on the Arabs the superiority of European arts over those of African.

As far back as 1785 Blanchard had made a parachute, to which a dog had been attached, and taken upward by a whirlwind: when again on a level with the car he recognised his master, and commenced barking; but, being raised a second time, he did not reach the ground in safety till some minutes after his master. Yet Garnerin seems to be "l'inventeur breveté du parachute," as appears from the following Republican pérmissive:—

DEPARTEMENT DE LA SEINE.

*L'Administration central du Département, au Citoyen Garnerin, Rue Dominique, près celle du Bac.*

CITOYEN, Paris, 2 Vendémiaire, an VIII. de la République Française, une et indivisible.

We have received your letter of the 4th, in which you demand the act of declaration herewith given. Having formed the design of taking an aerial voyage for the discovery of atmospheric currents, and other observations useful to science, you propose to enter within the states of the King of Prussia, should the wind convey you to the north or east; or into those of the King of Spain, should you be conducted to the south.

We give you this declaration, and we desire that no obstacle should impede you from obtaining the ends in view. However, should contrary winds convey you into states inimical to France, we should like to believe that you will there receive that succour and protection that General Buonaparte gave in Egypt to an English naturalist who was travelling in that country to make useful discoveries: *for the men who cultivate the arts and sciences labour for the good of all nations, and ought therefore to receive special protection.*

We wish you to observe, however, that in thus authorising you to make this experiment we only have in view the progress of science, and therefore you must have no other aim; the wonderful success that has attended your

previous voyages, and your descents in parachutes, of which you gave the first example, should not make you forget the prudence that in all cases should regulate your conduct.

Believe, citizen, that our wishes accompany your enterprise.

"Salut et fraternité,"

LECOUTEULZ. A. SAUZAY. SABATIER.

A few weeks later he received the following answer from "le Ministre de l'Intérieur":—

LIBERTÉ, ÉGALITÉ.

Paris, 21 Fructidor, An VIII. (1801) de la République Française, une et indivisible.

You offer me, Citizen, to assist with your aerostatic experiments the embellishment of the Fête of 1st Vendémiaire. I accept your offer, but these experiments should be limited to the following:—

1st. Two pilot balloons, to show the direction of the wind.

2nd. A gilt balloon to reflect the rays of the sun, and which will appear like a large star.

3rd. Your ascent and descent in a parachute.

For these three experiments you will receive 15,000 francs.

If my offer suits you, I authorise you to commence at once all that is necessary for the success of the undertaking.

LUCIEN BUONAPARTE.

M. Depuis Delcourt says:—

"M. J. Garnerin had been sent by the Government in 1793 as a Special Commissioner to the Army of the North, and was made prisoner on outpost duty at Marchiennes. He was incarcerated many months in the fortress of Bude, in Hungary, where he directed his thoughts to aerostation.

"'The love of liberty,' said he in the programme of his first descent in a parachute, 'so natural to a prisoner, gave rise to many projects to release myself from the rigorous detention. To surprise the vigilance of the sentries, pierce walls ten feet thick, throw myself from the rampartwithout being injured, were schemes that afforded recreation.

"'Blanchard's idea of presenting large surfaces to the air to increase its resistance, and the known acceleration of movement in all falling bodies, appeared to me only to require a careful mathematical comparison to be employed with certain success. I applied myself to the problem. After deciding on the size of a parachute for descending from a rampart or a precipice, by natural sequence I devised the size and form of a parachute for a descent of several thousand feet by an aeronaut.'"

Delalande the astronomer gives the following account of the first experiment:—

"At 5 P.M. on the 22nd October, 1797 (1er Brumaire, An VI.), the citizen Garnerin rose from the park of Monceau, a solemn silence pervaded the multitude; excitement and uneasiness was depicted in every countenance. When he had reached an altitude of more than 6000 feet, he cut the cord that attached him to the aerostat, which ascended till it exploded, whilst the parachute with the citizen Garnerin descended rapidly. The oscillations it underwent drew forth a cry from the spectators, and many women fainted. However, the citizen Garnerin descended on the plain of Monceau, got on horseback immediately, and returned to the park, in the midst of a crowd who loudly testified their approbation of the talent and courage of the young aeronaut. In fact, the citizen Garnerin is the first who has

ventured to try this hazardous experiment. He conceived the project in the fortress of Bude, in Hungary, where he was kept a long time as a state prisoner after the fierce combat of Marchiennes in 1793. I announced this success to the National Institute, and was heard with the utmost attention."

## CAN Y TYLWYTH TEG; OR, THE FAIRIES' SONG.

From grassy blades, and fenny shades,
My happy comrades hie;
Now day declines, bright Hesper shines,
And night invades the sky.
From noonday pranks, and thymy banks,
To Dolyd's dome repair,
For ours the joy that cannot cloy,
And mortals cannot share.

The light-latched door, the well-swept floor,
The hearth so trim and neat,
The blaze so clear, the water near,
The pleasant circling seat,
With proper care your needs prepare,
Your tuneful tabors bring;
And day shall haste to tinge the east,
Ere we shall cease to sing.

But first I'll creep where mortals sleep,
And form the blissful dream;
I'll hover near the maiden dear,
That keeps the hearth so clean;
I'll show her when that best of men,
So rich in manly charms,
Her Einiou, in vest of blue,
Shall bless her longing arms.

Your little sheaves or primrose leaves,
Your acorns, berries, spread;
Let kernels sweet increase the treat,
And flowers their fragrance shed;
And when 'tis o'er, we'll crowd the floor,
In jocund pairs advance,
No voice be mute, and each shrill flute,
Shall cheer the mazy dance.

When morning breaks, and man awakes,
From sleep's restoring hours,
The flocks, the field, his house we yield,
To his more active powers.
While clad in green, unheard, unseen,
On sunny banks we'll play,
And give to man his little span,
His empire of the day.—Old Song.

## ROBIN GOODFELLOW.

More swift than lightning can I fly
About this aëry welkin soone,
And in a minute's space descry
Each thing that's done below the moone:
There's not a hag
Or ghost shall wag,
Or cry,—"Ware goblin!" where I go;
But Robin I
Their feates shall spye,
And send them home with Ho! ho! ho

Whene'er such wanderers I meete,
As from their night sports they trudge home
With counterfeiting voice I greete,
And call on them with me to roame
Through woodes, through lakes,
Through bogges, through brakes;
Or else unseene with them I go,
All in the nicke,
To play some tricke,
And frolicke it with Ho! ho! ho!

Sometimes I meete them like a man;
Sometimes an ox, sometimes a hound;
And to a horse I turn me can,
And trip and trot about them round;
But if to ride
My backe they stride,
More swifte than winde away I go,
O'er hedge and lands,
Through pools and ponds,
I whirry, laughing Ho! ho! ho!

When lads and lasses merry be,
With possets and rich juncates fine,
Unseene of all the companie,
I eat their cakes and sip their wine.
And to make sport,
I puff and snort,
And out the candle I do blow;
And maids I kiss,
They shrieke—Who's this?
I answer nought but Ho! ho! ho!

Yet now and then, the maids to please,
At midnight I card up their wool;
And while they sleepe and take their ease,
With wheel to threads their flax I pull.
I grind at mill
Their malt up still,
I dress their hemp and spin their tow;
If any walke,
And would me talke,
I wend me laughing Ho! ho! ho!

When men do traps and engines set
In loopholes, where the vermines creepe,
Who from their fields and houses get
Their ducks and geese, and lambs and sheepe:
I spye the gin
And enter in,
And seeme a vermine taken so;
But when they theare
Approach me neare,
I leape out, laughing Ho! ho! ho!—BEN JONSON.

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*Fai.* Over hill, over dale,
Thorough bush, thorough brier,
Over park, over pale,
Thorough flood, thorough fire,
I do wander everywhere,
Swifter than the moones sphere;
And I serve the fairy queen,
To dew her orbs upon the green:
The cowslips tall her pensioners be;
In their gold coats spots you see;
Those be rubies, fairy favours,
In those freckles live their savours:
I must go seek some dew-drops here,
And hang a pearl on every cowslip's ear.
Farewell, thou lob of spirits, I'll be gone;
Our queen and all our elves come here anon.

*Midsummer Night's Dream.*

---

Oft fairy elves,
Whose midnight revels by a forest side,
Or fountain, some belated peasant sees,
Or dreams he sees, while o'erhead the moon
Sits arbitress, and nearer to the earth
Wheels her pale course, they on their mirth and dance
Intent, with jocund music charm his ear;
At once with joy and fear his heart rebounds.

MILTON.

ELVES AND THISTLE-DOWN.

In days of old, when Arthur fill'd the throne,
Whose acts and fame to foreign lands were blown,
The king of elves and little fairy queen
Gamboll'd on heaths, and danced on every green;
And where the jolly troop had led the round,
The grass unbidden rose, and mark'd the ground;
Nor darkling did they dance,—the silver light
Of Phœbe served to guide their steps aright,
And, with their tripping pleased, prolong'd the night.
Her beams they follow'd where at first she play'd,
Not longer than she shed her horns they stay'd:
From thence with airy flight to distant parts convey'd.
Above the rest our Britain held they dear,
More solemnly they kept their sabbaths here,
And made more spacious rings, and revell'd half the year.
I speak of ancient times, for now the swain,
Returning late, may pass the woods in vain,
And never hope to see the nightly train.

DRYDEN.

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They are flown,
Beautiful fictions of our fathers, wove
In Superstition's web when Time was young,
And fondly loved and cherish'd—they are flown,
Before the wand of Science! Hills and vales,
Mountains and moors of Devon, ye have lost
The enchantments, the delights, the visions all,
The elfin visions that so bless'd the sight
In the old days romantic. Naught is heard
Now, in the leafy world, but earthly strains—
Voices, yet sweet, of breeze, and bird, and brook,
And waterfall; the day is silent else,
And night is strangely mute! the hymnings high—
And immortal music, men of ancient times
Heard, ravish'd oft, are flown! O ye have lost
Mountains, and moors, and meads, the radiant throngs
That dwelt in your green solitudes, and fill'd
The air, the fields, with beauty, and with joy
Intense—with a rich mystery that awed
The mind, and flung around a thousand hearths
Divinest tales, that through the enchanted year
Found passionate listeners!
The very streams
Brighten'd with visitings of these so sweet
Ethereal creatures! They were seen to rise
From the charm'd waters, which still brighter grew
As the pomp pass'd to land, until the eye
Scarce bore the unearthly glory. Where they trod,
Young flowers, but not of this world's growth, arose,
And fragrance, as of amaranthine bowers,
Floated upon the breeze. And mortal eyes
Look'd on their revels all the luscious night;
And, unreproved, upon their ravishing forms
Gazed wistfully, as in the dance they moved
Voluptuous, to the thrilling touch of harp
Elysian.

CARRINGTON.

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Eye hath not seen it, my gentle boy;
Ear hath not heard its deep song of joy;
*Dreams* cannot picture a world so fair;
Sorrow and death may not enter there;
Time doth not breathe on its fadeless bloom;
For beyond the clouds, and beyond the tomb;—
It is there, it is there, my child.

MRS. HEMANS.

The joys of heaven are without example, above experience, and beyond imagination; for which the whole creation wants a comparison; we, an apprehension, and even the Word of God, a revelation.—NORRIS.

The song
Of heaven is ever new; for daily, thus,
And nightly, new discoveries are made
Of God's unbounded wisdom, power, and love,
Which give the understanding larger room,
And swell the hymn with ever-growing praise.

POLLOK.

# CHAPTER V.

REMARKABLE ASCENTS FROM 1800 TO 1825 — NAPOLEON'S EXTRAORDINARY OMEN.

Hoch übern niedern Erdenleben
Soll sie im blauen Hinmelszelt,
Die Nachbarin des Donner's, schweben
Und grenzen an die Sternenwelt.

Above this nether world shall she
In heaven's azure vault appear,
The neighbour of the thunder be,
And border on the starry sphere.

SCHILLER, *Song of the Bell.*

LONDON TO COLCHESTER IN FORTY-FIVE MINUTES — GARNERIN'S DESCENT IN A PARACHUTE — COUNT ZAMBECCARI AND DR. GRASSATI FALL INTO THE ADRIATIC — SCIENTIFIC EXPERIMENTS AT ST. PETERSBURG — MM. BIOT AND GAY LUSSAC — A SECOND ASCENT TO 23,000 FEET — NAPOLEON'S OMEN — VINCENT LUNARDI DIES IN A CONVENT NEAR LISBON — NOCTURNAL EXCURSIONS — FIRST ATTEMPT TO CROSS THE IRISH CHANNEL — FALLING INTO THE SEA — SECOND ATTEMPT SUCCESSFUL.

1802.—MONS. GARNERIN came to England in 1802, and made many successful voyages; one remarkable for rapidity, on 28th of June, when he ascended with Captain Snowden, R.N., from Chelsea Gardens, and came down near Colchester, in forty-five minutes.

The excitement this ascent caused is shown by the following statement:—"Not only were Chelsea Gardens crowded, and the river covered with boats, but even the great road from Buckingham Gate was absolutely impassable, and the carriages formed an unbroken chain from the turnpike to Ranelagh Gate."

The balloon passed immediately over Duke Street, and kept a line between the river on one side, and the Strand, Fleet Street, Ludgate Hill, and St. Paul's Churchyard on the other. No balloon had ever passed so directly over the metropolis, or had ever been gazed on by so many spectators. Mons. Garnerin wrote to London as follows:—"I take the earliest opportunity of informing you that, after a very pleasant journey, but after the most dangerous descent I ever made, on account of the boisterous weather, and the vicinity of the sea, we alighted at the distance of four miles from this place, and *sixty* from Ranelagh. We were only *three-quarters of an hour* on the way. To-night I intend to be in London, with the balloon, which is torn to pieces. We ourselves are all over bruises."

On the 5th July, Mons. Garnerin ascended from Marylebone, and descended at Chingford, a distance of seventeen miles, in fifteen minutes, and attained also during this interval a height of 7800 feet.

On the 21st September, after having made many ascents in all parts of the country, he tried an experiment with a parachute, and ascended from St. George's Parade, North Audley Street.

I will give extracts from his own account, which appeared in the 'Annual Visitor':—

. . . . . I had reached a height of 10,000 feet, and measured with my eye the vast space that separated me

from the rest of the human race. I felt my courage confirmed by the certainty that my combinations were just. I then took out my knife, and *with a hand firm, from a conscience void of reproach, and which had never been lifted against any one but in the field of victory*, I cut the cord. My balloon rose, and I felt myself precipitated with a velocity which was checked by the sudden unfolding of my parachute. I saw that all my calculations were just, and my mind remained calm and serene. I endeavoured to modulate my gravitation, and the oscillation that I experienced increased in proportion to my approach to the breezes that blow in the middle regions. Nearly ten minutes had elapsed, and I felt the more time I took in descending the safer I should reach the ground. At length I perceived thousands of people, some on horseback, were following and encouraging me. After one bound I quitted the parachute without accident. I was instantly seized and carried in triumph; but sickness had been produced by the rocking, which always had this effect on me, so I obtained permission for a few minutes' repose, and then got on a horse. Among the horsemen I saw the Duke of York and Lord Stanhope. Among the congratulations I had the honour of receiving I was much flattered by that of Sir Sidney Smith, who came to me with General Douglas, "on purpose," as he said, "to shake hands with a brave man." This compliment is of the greatest value from the mouth of one of the bravest soldiers in Europe. I can now answer the fallacious query of a correspondent to one of the public papers, who asks "Whether I did not play an infamous part in the French Revolution?" There are in France but two—my brother and myself—of the name of Garnerin, and we have played no other part than that which honour may avow in all countries, and at all times. It was upon her frontiers, and in the bosom of her armies, that we endeavoured to be useful to our country. I might refer, in England, to incontestable evidence relative to my conduct. I am sure H.R.H. the Duke of York would be disposed to do me the justice I deserve, if he recollects the action of Marchiennes, on the night of 31st October, 1793, in which I had the honour of disputing with a handful of men, that post, after it had been surprised by a strong detachment of his army. The action was extremely bloody, and terminated in a surrender, which made me H.R.H.'s prisoner, and occasioned me thirty-one months' imprisonment in Austria.

1803.—Count Zambeccari, Dr. Grassati, of Rome, and Sr. Andreoli, of Ancona, ascended in a Montgolfière from Bologna, on the 7th October, 1803, at midnight; the inflation not having been completed before that time, and the populace being too impatient for the experiment, to wait till morning. They took up with them lanterns, and other things necessary for observing the instruments at night. The balloon rose with a most surprising velocity, and soon reached such a height that their fingers were almost frozen by the cold, when both Zambeccari and Grassati fell into a state of deep sleep. Andreoli retained the use of his senses. About 2 A.M. the balloon began to descend. When they came to they found themselves falling into the Adriatic. The lantern had gone out, and was with much difficulty lighted. They fell into the water, and were drenched. To avoid greater harm they threw out ballast, and rose through three strata of clouds, and their clothes were covered with rime. In this situation they were deaf, and unable to hear each other speak. About 3 A.M. the balloon again descended, and bounded in and out of the sea till 8 A.M. When on the coast of Istria, one Antonio Bazol picked them up in his ship. The balloon, left to itself, ascended to an amazing elevation, and fell in some part of Turkey. The height they attained was conjectured to exceed five miles. Bulletins of their health were published daily at Venice and Bologna. Count Zambeccari, who had suffered most, lost the fingers from one hand.

1804.—In the summer of 1804, M. Robertson ascended from St. Petersburg, and the following is the account of his companion, Sacharof. The object of this voyage was to ascertain the physical state of the atmosphere, as the Academy were of opinion that results differing from those of De Luc, Saussure, and Humboldt, on the summit of mountains, would be obtained:—

Our Charlière rose slowly at 7.15 P.M. from the garden of the 1st Corps of Cadets; the wind was north-east.

FRANÇOIS PILATRE DE ROZIER.

Photo-zincographed at the Ordnance Survey Office, Southampton under the superintendence of Capt.n H. Wilson and James R.E. Col. Sir H. James R.E. F.R.S. &c. Director.

1864

The difference of the atmosphere when over the Neva caused us to descend; throwing out ballast, we again ascended. At 8.45 P.M. we had a beautiful view of the Newski Islands and the whole course of the river Yamelianoska. By 9.20 P.M. our barometer had fallen from thirty to twenty-three inches. I threw out at this altitude a canary and a dove; the former fell with precipitation, and the latter sailed down to the village immediately below us. We now threw out all our ballast, a spare greatcoat, and the remains of supper, so as to enable us to rise higher. About 9.30 P.M. the barometer fell to twenty-two inches. At this height we saw half the sun; on account of the fog we could not say whether the other half was hid by the horizon or by a cloud. Experiments were here made. My pulse and breathing were the same as on the earth, the former eighty-two and the latter twenty-two per minute. There were white clouds at a great height over us; though the sky was clear we could observe no stars. I proposed to continue our voyage till sunrise, that we might enjoy that glorious sight, but Mr. Robertson could not accede to my proposal, on account of our ignorance of the country and our want of ballast. I took out a speaking-trumpet, and directed the sound downwards; after ten seconds I heard an echo; this was repeated, but I was unable to look at the barometer, as it was already packed up. We descended rapidly, but when our bundle touched the earth we perceived a slight inclination to rise. As the wind was strong we dragged it along, and the shaking this occasioned caused most of the instruments to be spoilt. At 10.45 P.M. we left the car on the estate of Counsellor Demidof, and were assisted by his boors and servants.

1804.—I give Mr. Wise's account of the scientific experiments made in August and September of this year:—

AERIAL VOYAGE OF GAY LUSSAC AND BIOT — THEIR EXPERIMENTS. — SECOND ASCENT OF LUSSAC — HIS EXPERIMENTS.

After the capitulation of Cairo, the balloon which had been sent to Egypt was returned to Paris, after the French army had returned from the African deserts. Two young and ardent French philosophers, MM. Biot and Gay Lussac, proposed to undertake an aerial excursion, in order to examine the magnetic force at great elevations, and to explore the constitution of the higher atmosphere and its electrical properties. For such a philosophical enterprise they were eminently qualified, having been educated together at the Polytechnic School of Paris, and both of them deeply versed in mathematics; the former indulging in a wide range of study, and the latter concentrating his efforts more on chemistry, and its application to the arts. Their offer to Government was seconded by Berthollet and Laplace; and the celebrated chemist Chaptal, then Minister of the Interior, gave it his patronage and warm support. The war-balloon which had once been in Egypt was now given to the custody of Biot and Gay Lussac; and the same artist who constructed it was, at the public expense, ordered to refit and prepare it, under their direction. Besides the usual provision of barometers, thermometers, hygrometers, and electrometers, they had two compasses and a dipping needle, with another fine needle, carefully magnetised, and suspended by a very delicate silk thread, for ascertaining by its vibrations the force of magnetic attraction. To examine the electricity of the different strata of the atmosphere they carried several metallic wires, from sixty to three hundred feet in length, and a small electrophorus feebly charged. For galvanic experiments, they had procured a few discs of zinc and copper, with some frogs, to which they added some insects and birds. It was also intended to bring down a portion of air from the higher regions, to be subjected to a chemical analysis, and for this purpose a flask, carefully exhausted, and fitted with a stopcock, had been prepared for them.

The balloon was placed in the garden of the *Conservatoire des Arts*, or Repository of Models, formerly the Convent of St. Martin; and no pains were spared by Col. Coutelle in providing whatever might contribute to the greater safety and convenience of the experimental voyagers. Everything being now ready for their ascent, these adventurous philosophers, in the presence of a few friends, embarked in the car at ten o'clock on the morning of the 23rd of August, 1804. The barometer was then at 30·13 inches, the thermometer at 61° on Fahrenheit's scale, and Saussure's hygrometer pointed at 80·8°, or very nearly the limit of absolute humidity. They rose with a slow and imposing motion. Their feelings were at first absorbed in the novelty and magnificence of the spectacle which opened before them; and their ears were saluted with the buzz of distant gratulations, sent up from the admiring spectators. In a few minutes they entered the region of the clouds, which seemed like a thin fog, and gave them a slight sensation of humidity. The balloon had now become quite inflated, and they were obliged to let part of the gas escape by opening the upper valve; at the same time they threw out some ballast, to gain a greater elevation. They now shot up through the range of clouds, and reached an altitude of about 6500 English

feet. These clouds, viewed from above, had the ordinary whitish appearance; they all occupied the same height, only their upper surface seemed marked with gentle swells and undulations, exactly resembling the aspect of a wide plain covered with snow.

MM. Biot and Gay Lussac now begun their experimental operations. The magnetic needle was attracted, as usual, by iron; but they found it impossible at this time to determine with accuracy its rate of oscillation, owing to a slow rotary motion with which the balloon was affected. In the mean while, therefore, they made other observations. A voltaic pile, consisting of twenty pairs of plates, exhibited all its ordinary effects, gave the pungent taste, excited the nervous commotion, and occasioned the decomposition of water. By rejecting some more ballast they had attained the altitude of 8940 feet, but afterwards settled to that of 8600 feet. At this great elevation the animals which they carried with them appeared to suffer from the rarity of the air. They let off a violet bee, which flew away swiftly, making a humming noise. The thermometer had fallen to 56° Fahrenheit, yet they felt no cold; they were, on the contrary, scorched by the sun's rays,* and were obliged to lay aside their gloves. Both of them had their pulses much accelerated; that of Biot, which generally beat seventy-six times in a minute, was raised to one hundred and eleven; while the pulse of his friend, Gay Lussac, a man of a less robust frame, was heightened from sixty to eighty beats in the minute. Notwithstanding their quickened pulsation, however, they experienced no sort of uneasiness, nor any difficulty in breathing.

What perplexed them most was the difficulty of observing the oscillations of a delicately-suspended magnetic needle. But they soon remarked, on looking attentively down upon the surface of the conglomerated clouds, that the balloon slowly revolved, first in one direction, and then returned the contrary way. Between the opposite motions there intervened short pauses of rest, which it was necessary for them to seize. Watching, therefore, the moments of quiescence, they set the needle to vibrate, but were unable to count more than five, or, very rarely, ten oscillations. A number of trials, made between the altitudes of 9500 and 13,000 feet, gave 7″ for the mean length of an oscillation, while, at the surface of the earth, it required $7\frac{1}{2}\frac{1}{0}$″ to perform each oscillation. A difference so very minute as the hundred and fortieth part could only be imputed to the imperfection of the experiment; and it was hence fairly concluded that the force of magnetic attraction had in no degree diminished at the greatest elevation which they could reach. The direction of this force, too, seemed, from the concurring circumstances, to have continued the same; though they could not depend on observations made in their vacillating car with so delicate an instrument as the dipping needle.

At the altitude of 11,000 feet they liberated a green linnet, which flew away directly; but, soon feeling itself abandoned in the midst of an unknown ocean it returned and settled on the stays of the balloon. Then, mustering fresh courage, it took a second flight, and dashed downwards to the earth, describing a tortuous yet almost perpendicular track. A pigeon, which they let off under similar circumstances, afforded a more curious spectacle. Placed on the edge of the car, it rested a while, measuring, as it were, the breadth of that unexplored sea which it designed to traverse; now, launching into the abyss, it fluttered irregularly, and seemed at first to try its wings on the thin element, till, after a few strokes, it gained more confidence, and whirling in large circles or spirals, like the birds of prey, it precipitated itself towards the mass of extended clouds, where it was lost from sight.

It was difficult, in those lofty and rather humid regions, to make electrical observations; and the attention of the scientific navigators was, besides, occupied chiefly by their magnetical experiments. However, they let down from the car an insulated metallic wire of about 250 feet in length, and ascertained, by means of the electrophorus, that the upper end indicated resinous or negative electricity. This experiment was several times repeated, and it seemed to corroborate fully the previous observations of Saussure and Volta relative to the increase of electricity met with in ascending the atmosphere.

The diminution of temperature in the higher regions was found less than what it generally is at the same altitude on mountains.† The hygrometer, or rather hygroscope, of Saussure advanced regularly towards dryness, in proportion to the altitude which they attained. At the elevation of 13,000 feet it had changed from 80·8° to 30°. But still the conclusion that the air of the higher strata is drier than that of the lower, we are inclined to consider as fallacious. In fact, the indications of the hygroscope depend on the relative attraction for humidity possessed by the substance employed, and the medium in which it is immersed. But air has its disposition to retain moisture

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* I have always found the sun oppressive when sailing over dense strata of clouds, which is caused by reflection. This was the case in this instance.

† This want of diminution was caused by the reflection of the sun from the cloud stratum below them.

always augmented by rarefaction, and consequently such alteration alone must materially affect the hygroscope. The only accurate instrument for ascertaining the condition of air with respect to dryness is founded on a property of evaporation. But we shall afterwards have occasion to refer to this.

The ballast now being almost expended, it was resolved to descend. The aeronauts, therefore, pulled the upper valve and allowed part of the hydrogen gas to escape. They dropped gradually, and when they came to the height of 4000 feet they met the stratum of clouds, extending horizontally, but with a surface heaved in gentle swells. When they reached the ground no people were near them to stop the balloon, which dragged them in the car to some distance along the fields. From this awkward and even dangerous situation they could not extricate themselves without discharging a great quantity of gas, and therefore gave up the idea of sending Gay Lussac up alone to explore the highest regions. It has been reported that his companion Biot, though a man of activity and not deficient in personal courage, was so much overpowered by the alarms of their descent as to lose for the time the entire possession of himself. The place where they alighted, at half-past one o'clock, after three hours and a half spent in the midst of the atmosphere, was near the village of Meriville, in the department of the Loiret, and about fifty miles from Paris.

Several philosophers of Paris now desired that Gay Lussac should mount a second time and repeat the different observations at the greatest elevation he could attain. Experience had instructed him to reduce his apparatus, and to adapt it better to the actual circumstances. As he could only count the vibrations of the magnetic needle during the very short intervals which occurred between the contrary rotations of the balloon, he preferred one about six inches in length, which, therefore, oscillated more quickly. The dipping needle was magnetised and adjusted by the ingenious M. Coulomb. To protect the thermometer from the direct action of the sun, it was enclosed within two concentric cylinders of pasteboard covered with gilt paper. The hygrometers, constructed by Richer's mode, with four hairs, were sheltered nearly in the same way. The two glass flasks, intended to bring down air from the highest regions of the atmosphere, had been exhausted, till the mercurial gauge stood at the twenty-fifth part of an inch, and their stopcocks were so perfectly fitted that, after the lapse of eight days, they still preserved the vacuum. These articles, with two barometers, were the principal instruments which Gay Lussac took with him. The skill and intelligence of the artist had been exerted in further precautions for the safety of the balloon.

At forty minutes after nine o'clock on the morning of the 15th of September, 1804, the scientific voyager ascended, as before, from the garden of the Repository of Models. The barometer then stood at 30·66 English inches, the thermometer at 82° Fahr., and the hygrometer at 57½°. The sky was unclouded, but misty. Scarcely had the observer reached the height of 3000 feet when he observed spread below him, over the whole extent of the atmosphere, a thin vapour, which rendered the distant objects very indistinct. Having gained an altitude of 9950 feet he set his needle to vibrate, and found it to perform twenty oscillations in 83″, though it had taken 84·33″ to make the same number at the surface of the earth. At the height of 12,680 feet he discovered the variation of the compass to be precisely the same as below; but with all the pains he could take he was unable to determine with sufficient certainty the dip of the needle. Gay Lussac continued to prosecute his other experiments with the same diligence, and with greater success. At the altitude of 14,480 feet he found that a key, held in the magnetic direction, repelled with its lower end and attracted with its upper end the north pole of a needle of a small compass. This observation was repeated, and with equal success, at the vast height of 20,150 feet—a clear proof that the magnetism of the earth exerts its influence at remote distances. He made not fewer than fifteen trials at different altitudes with the oscillations of his finely-suspended needle. It used generally to vibrate twenty or thirty times. The mean result gives 4·22″ for each oscillation, while it is 4·216″ at the surface of the earth—an apparent difference so extremely small as to be fairly neglected.

During the whole of this gradual ascent he noticed, at short intervals, the state of the barometer, the thermometer, and the hygrometer. Of these observations, amounting in all to twenty-one, he has given a tabular view. We regret, however, that he has neglected to mark the times at which they were made, since the results appear to have been very materially modified by the progress of the day. It would likewise have been desirable to have compared them with a register noted every half-hour at the Observatory. From the surface of the earth to the height of 12,125 feet the temperature of the atmosphere decreased regularly from 82° to 47·3° by Fahrenheit's scale; but afterwards it increased again and reached to 53·6° at the altitude of 14,000 feet; evidently owing to the influence of the warm currents of air which, as the day advanced, rose continually from the heated ground. From that point the temperature diminished, with only slight deviations from a perfect regularity. At the height of 18,636 feet the

thermometer subsided to 32·9°, on the verge of congelation; but it sunk to 14·9° at the enormous altitude of 22,912 feet above Paris, or 23,040 feet above the level of the sea, the utmost limit of the balloon's ascent.

From these observations no conclusive inference, we think, can be drawn respecting the mean gradation of cold which is maintained in the higher regions of the atmosphere; for, as we have already remarked, the several strata are, during the day, kept considerably above their permanent temperature by the hot currents raised from the surface through the action of the sun's rays. If we adopt the formula given by Professor Leslie at the end of his 'Elements of Geometry,' which was the result of some accurate and combined researches, the diminution of temperature corresponding to the first part of the ascent, or 12,125 feet, ought to have been 40° Fahr. It was actually 34·7°, and would, no doubt, have reached to 40°, if the progressive heating of the surface, during the interval of time, were taken into the account. In the next portion of the voyage, from the altitude of 14,000 to that of 18,636 feet, or the breadth of 4636 feet, the decrement of temperature, according to the formula, should have been only 16¼°, instead of 20·7°, which was really marked—a proof that the diurnal heat from below had not yet produced its full effect at such a great height. In the last portion of the balloon's ascent, from 18,636 feet to 22,912, a range of 4276 feet, the decrease of heat ought to have been 15½°, and it was actually 18°; owing, most probably, to the same cause, or the feebler influence which warm currents of air from the surface exert at those vast elevations. Taking the entire range of the ascent, or 22,912 feet, the diminution of temperature, according to the same formula, would be for the graduation of temperature in ascending the atmosphere 85·4°. The decrease actually observed would be 67·1°, which might be raised to 80°, if we admit the very probable supposition that the surface of the earth had become heated from 82° to 94·9° during the interval between ten o'clock in the morning and near three in the afternoon, when the balloon floated at its greatest elevation.

After making fair allowances therefore, on account of the operation of deranging causes, the results obtained by Guy Lussac, for the gradation of temperature in the atmosphere, appear, on the whole, to agree very nearly with those derived from the formula which theory, guided by delicate experiments, had before assigned. This gradation is evidently not uniform, as some philosophers have assumed, but proceeds with augmented rapidity in the more elevated regions. The same conclusion results from a careful inspection of the facts which have been stated by other observers.

The hygrometers, during the ascent of the balloon, held a progress not quite so regular, but tending obviously towards dryness. At the height of 9950 feet they had changed from 57·5° to 62°; from which they continued afterwards to decline, till they came to mark 27·5° at the altitude of 15,190 feet. From this inferior limit the hygrometers advanced again, yet with some fluctuations, to 35·1°, which they indicated at the height of 18,460 feet. Above this altitude the variation was slight, though rather inclining to humidity. There can exist no doubt, however, that, allowing for the influence of the prevailing cold, the higher strata of the atmosphere must be generally drier than the lower, or capable of retaining, at the same temperature, a larger share of moisture.

At the altitude of 21,460 feet Gay Lussac opened one of his exhausted flasks, and, at that of 21,790 feet, the other. The air rushed into them through the narrow aperture with a whistling noise. He still rose higher; but, at eleven minutes past three o'clock, he had attained the utmost limit of his ascent, and was then 22,912 feet above Paris, or 23,040 feet (being more than four miles and a quarter) above the level of the sea. The air was now more than twice as thin as ordinary, the barometer having sunk to 12·95 inches. From that tremendous altitude, 1600 feet higher than the summit of the Andes, more elevated than the loftiest pinnacle of our globe (the Himalayas), and far above the height to which any mortal had ever soared, the aerial navigator might have indulged the feelings of triumphant enthusiasm. But the philosopher, in perfect security, was more intent on calmly pursuing his observations. During his former ascent he saw the fleecy clouds spread out below him, while the canopy of heaven seemed of the deepest azure, more intense than Prussian blue. This time, however, he perceived no clouds gathered near the surface, but remarked a range of them, stretching at a very considerable height over his head; the atmosphere, too, wanted transparency, and had a dull, misty appearance. The different aspect of the sky was probably owing to the direction of the wind, which blew from the north-west in his first voyage, but in his second from the south-east.

While occupied with experiments at this enormous elevation, he began, though warmly clad, to suffer from excessive cold, and his hands, by continual exposure, grew benumbed. He felt likewise a difficulty in breathing, and his pulse and respiration were much quickened. His throat became parched from inhaling the dry attenuated air, so that he could hardly swallow a morsel of bread; but he experienced no other direct inconvenience from his situation. He had indeed been affected, through the whole of the day, with a slight headache, brought on by the preceding fatigues and want of sleep; but though it continued without abatement, it was not increased by his ascent.

The balloon was now completely distended, and not more than 33 lbs. of ballast remained: it began to drop, and Gay Lussac, therefore, only sought to regulate its descent. It subsided very gently, at the rate of about a mile in eight minutes; and after the lapse of about thirty-four minutes, or at three-quarters after three o'clock, the anchor touched the ground and instantly secured the car. The voyager alighted with great ease near the hamlet of St. Gourgan, about sixteen miles from Rouen. The inhabitants flocked around him, offering him assistance, and eager to gratify their curiosity.

As soon as he reached Paris he hastened to the laboratory of the Polytechnic School, with his flasks, containing air of the higher regions, and proceeded to analyse it in the presence of Thenard and Gresset. Opened under water, the liquid rushed into them, and apparently half filled their capacity. The transported air was found, by a very delicate analysis, to contain exactly the same proportions as that collected near the surface of the earth, every 1000 parts holding 215 of oxygen. From concurring observations, therefore, we may conclude that the atmosphere is essentially the same in all situations.

The ascents performed by MM. Biot and Gay Lussac are memorable, as being the first ever undertaken solely for objects of science. It is impossible not to admire the intrepid coolness with which they conducted those experiments, operating, while they floated in the highest regions of the atmosphere, with the same composure and precision as if they had been quietly seated in their cabinet at Paris. Their observations on the force of terrestrial magnetism show, most conclusively, its deep source and wide extension. The identity of the constitution of the atmosphere to a vast altitude was likewise ascertained. The facts noted by Gay Lussac, relative to the state of the thermometer at different heights, appear generally to confirm the law which theory assigns for the gradation of temperature in the atmosphere; but many interesting points were left untouched by this philosopher. We are sorry that he had not carried with him the *cyanometer*, which enabled Saussure to determine the colour of the sky on the summits of the Swiss mountains; still more do we regret that he was not provided with an hygrometer and a photometer, of Leslie's construction. These delicate instruments could not have failed, in his hands, to furnish important data for discovering the relative dryness and transparency of the different strata of air. It would have been extremely interesting, at such a tremendous height, to have measured with accuracy the feeble light reflected from the azure canopy of heaven, and the intense force of the sun's direct rays, and hence to have determined what portion of them is absorbed in their passage through the lower and denser atmosphere. . .

### Suggestions on the Use of Balloons soon after their Discovery.

Balloons have at different times been thought capable of useful application. It has been even proposed to employ their power of ascension as a mechanical force. This might be rendered efficient, it was believed, to raise water from mines, or to transport obelisks and place them on great elevations. We can easily imagine situations where a balloon could be used with advantage; such as to raise, without any scaffolding, a cross or a vane to the top of a high spire; but the power would then be purchased at a very disproportionate expense. It would require four and a half pounds of iron, or six of zinc, with equal quantities of sulphuric acid, to yield hydrogen gas sufficient to raise up the weight of a pound. Balloons have rendered important service in reconnoitring the face of a country and communicating military signals; and it is rather surprising that a system which promised such obvious advantages has not been carried much farther.

But to a skilful and judicious application of balloons we may yet look for a most essential improvement of the infant science of meteorology. Confined to the surface of this globe, we have no direct intimation of what passes in the lofty regions of the atmosphere. All the changes of weather, which appear so capricious and perplexing, proceed, no doubt, from the combination of a very few simple causes. Were the philosopher to penetrate beyond the seat of the clouds, examine the circumstances of their formation, and mark the prevailing currents, he would probably remove, in part, the veil that conceals those mighty operations. It would be quite practicable, we conceive, to reach an elevation of seven miles, where the air would be four times more attenuated than ordinary. A silk balloon of forty feet diameter, if properly constructed, might be sufficient for that enormous ascent, though not more than one-fourth filled with hydrogen gas. The voyager would not, we presume, suffer any serious inconvenience from breathing the thin air;* the animal frame adapts itself with wonderful facility to external circumstances.

* He would suffer from a diminution of atmospheric pressure. At the surface of the earth an ordinary sized man sustains an atmospheric pressure of over 25,000 pounds, while at the height of seven miles he would have but 6500 pounds. From what I have experienced at three and a quarter miles high, I would suppose very serious consequences would ensue at the immense height of seven miles.

Perhaps the quickened pulse and short respiration which some travellers have experienced on the summits of lofty mountains should be attributed chiefly to the suddenness of their transition and the severity of the cold. The people of Quito live comfortably 9560 feet above the level of the sea; and the shepherds of the hamlet of Antisana, the highest inhabited spot in the known world, who breathe, at an elevation of 13,500 feet, air that has only three-fifths of the usual density, are nowise deficient in health or vigour. But the intenseness of the cold is, probably, what the resolute observer would have most to dread, at the height of seven miles. This decrease of temperature, perhaps equal to 148°, might extend below the point at which mercury freezes; yet several circumstances tend to mitigate such extreme cold, and proper clothing might enable an experimenter for a short time to resist its effects.

Much could be done, however, without risk or material expense. Balloons from fifteen to thirty feet in diameter, and carrying register thermometers and barometers, might be capable of ascending alone to altitudes between eight and twelve miles. Despatched from the centres of the great continents, they would not only determine the extreme gradations of cold, but indicate by their flight the direction of the regular and periodic winds, which doubtless obtain in the highest regions of the atmosphere.

But we will not enlarge. In some happier times such experiments may be performed with the zealous concurrence of different Governments, when nations shall at least become satisfied with cultivating the art of peace instead of war.

1804.—Zambeccari's experiments in a Montgolfière, in October, I will leave to my Tenth Chapter, where the greatest suffering shall be contrasted with the greatest enjoyment; it was made, like his previous ascents, from Bologna.

### Napoleon's Coronation Balloon.

Las Cases, in his 'Private Life of Napoleon at St. Helena' (vol. iii. part 2, p. 313), says of him, "He mentioned, as a sort of prodigy, the circumstance of the balloon which ascended at his coronation having fallen, in the space of a few hours, in the neighbourhood of Rome."

> Coming from Sardis, on our foremost ensign,
> Two mighty eagles fell, and there they perch'd,
> Gorging and feeding from our soldiers' hands.
> This morning they are fled away, and gone;
> And in their stead, do ravens, crows, and kites
> Fly o'er our heads, and downward look on us,
> As we were sickly prey: their shadows seem
> A canopy most fatal, under which
> Our army lies, ready to give up the ghost.
>
> Shakspeare.

This remarkable incident well illustrates the fatalism of Napoleon's character. The man of destiny believes in the destiny of man; he relies solely on his star; and, from the height of his station, the newly elect, consecrated Emperor and King, by a Pope, sees an evil omen in a fortuitous circumstance, insignificant for any other but himself. The account is as follows:—

It was at this time that the form "Salut et fraternité," as well as the republic "une et indivisible," disappear; and the Minister of the Interior, S. E. M. de Champagny, now writes to Mons. Garnerin, "aerostier des fêtes publiques," in the following tone:—

> I send you, sir, a copy of the programme of the rejoicings which are to take place at the coronation of His Majesty the Emperor. I look to that zeal and activity you have already displayed for the prompt execution of the necessary preparations.
>
> Your estimate of the cost has been placed before me, and I hope that you will be able to economise, as the Government has decided on not spending more than 23,500 francs on your account.
>
> Champagny.

At 11 P.M., on the 16th December, Garnerin allowed his "colossal machine" to rise from the square in front of Nôtre Dame. "One sees it rise slowly and majestically. Not less than 3000 lights add to its beauty. It is, indeed, a fine sight; but who could then guess the direction it would take, or the sensation it would cause?" However, on the following morn,* at break of day, some of the inhabitants of Rome see at the horizon a brilliant globe coming towards their city. It is soon over St. Peter's and the Vatican; descends, rises again, somewhat torn; keeps near the ground, and falls into Lake Bracciano.

Here its pursuers first learn from whence it had come; for, on drawing it from the water, they read in gilt letters on its vast circumference, "Paris, 25 Frimaire, An XIII., Couronnement de l'Empereur Napoléon par S.S. Pie VII."

For distance and rapidity this flight would always have been remarkable; but, considering the day on which it took place, it appears almost miraculous. A circumstance in addition, very trifling in itself, became of great importance in the eyes of Napoleon. A political turn, would any one believe it? was given to the voyage of a "ballon perdu." The balloon, on its course near the ground, left part of its crown on an angle of the tomb of Nero. The Italian papers, not being under such rigorous censure as those of France, innocently related the coincidence; some, however, added malicious remarks, injurious to the Emperor.

This came at length to the ear of the master, some one even speaking of it at one of his levées. Napoleon showed his displeasure, and ordered that no further remark should be made about Garnerin's balloon.

Napoleon had formerly applauded the courage of Coutelle, chief of the aerostatic corps, and appreciated its importance for the engineer department. He had also, when in Egypt, ordered Conté to send up balloons, to show the Arabs the superiority of European arts over those of old and degenerate Egypt. From the coronation, then, of Napoleon, dates his antipathy to aerostation. The military aerostatic school of Meudon was abandoned, and the results of experiments lost. Who knows but that this might not have caused him to turn a deaf ear to Fulton, when he came to the camp at Boulogne, offering to apply steam to navigation? Little causes often engender great effects. Garnerin ceased to be employed by Government, and to Madame Blanchard was confided the ascents at fêtes. Thus the birth of the King of Rome, on the 20th of March, 1811, was announced by bulletins scattered from a balloon that rose under the direction of Madame Blanchard; whilst Garnerin, in his notes, remarks on the poorness of this affair, and sighs that it had not been intrusted to him, who had made flights from Paris to Aix-la-Chapelle and Mont Tonnerre, beside spending nights in the bosom of the clouds." Garnerin, moreover, offered to cross the sea, and announce to "La perfide Albion" the birth of the royal child.†

The coronation balloon was suspended in a corridor of the Vatican, where it remained till 1814, with an inscription and date, but omitting any reference to Nero's tomb.

In 1806 the death of Vincent Lunardi is thus briefly chronicled by the 'Gentleman's Magazine':—

*July* 31.—Died in the convent of Barbadinas at Lisbon, of a decline, Mr. Vincent Lunardi, the celebrated aeronaut.

* In the Diaries of a Lady of Quality (p. 78) it is said to be 26 hours: further particulars on this most singular incident would be extremely interesting.

† Extract from Depuis Delcourt's 'Manual d'Aerostation.'

In the same year Carlo Brioschi, astronomer royal at Naples, in company with Andreani, the first Italian aeronaut, attempted to rise from Naples to a greater height than Gay Lussac reached. From the expansion of the gas in the rare atmosphere their balloon burst; but its fragments checked the velocity of the descent, and they fell to the ground, with no immediate material injury. Brioschi, however, contracted a disease, from which he suffered till his death in 1833.

1807.—The *nocturnal* aerial excursions of M. Garnerin in this year must be ranked among one of the most enterprising and adventurous.

Mr. Wise gives the following concise account of these adventures:—

At eleven o'clock on the evening of the 4th of August, he ascended from Tivoli, at Paris, under the Russian flag, as a token of the peace that subsisted between France and Russia. His balloon was illuminated by twenty lamps: and to obviate all danger of communication between these and the hydrogen gas which it might be necessary to discharge in the course of the voyage, the nearest of the lamps was fourteen feet distant from the balloon, and conductors were provided to carry the gas away in an opposite direction. After his ascent, rockets, which had been let off from Tivoli, seemed to him scarcely to rise above the earth, and Paris, with all its lamps, appeared like a plain studded with luminous spots. In forty minutes he found himself at an elevation of 13,200 feet, when, in consequence of the dilatation of the balloon, he was under the necessity of discharging part of the inflammable air. About twelve o'clock, when 3600 feet from the earth, he heard the barking of dogs; about two he saw several meteors flying around, but none of them so near as to create apprehension. At half-past three he beheld the sun emerging in brilliant majesty above an ocean of clouds; and the gas in the balloon being thereby expanded, it soon rose 15,000 feet above the surface of the earth, where he felt the cold exceedingly intense. In seven hours and a half from his departure M. Garnerin descended near Loges, forty-five leagues distant from Paris.

This same intrepid aeronaut undertook a second nocturnal voyage on the 21st of September, 1807, in the course of which he was exposed to the most imminent danger. M. Garnerin, prognosticating an approaching storm from the state of the atmosphere, refused to be accompanied by M. de Chassenton, who earnestly requested it. He ascended, therefore, alone from Tivoli, at ten o'clock, and was carried up with unexampled rapidity to an immense height above the clouds. The balloon was then dilated to an alarming degree, and M. Garnerin, having been prevented by the turbulence of the mob, before his ascent, from regulating those parts of the apparatus which were meant to conduct the gas away from the lamps on its escape, was totally incapable of managing the balloon. He had no alternative left, therefore, than with one hand to make an opening, two feet in diameter, through which the inflammable air was discharged in great quantities, and with the other to extinguish as many of the lamps as he could possibly reach. The aeronaut was now without a regulating valve, and the balloon, subject to every caprice of the whirlwind, was tossed about from current to current. When the storm impelled him downwards, he was forced to throw out his ballast to restore the ascending tendency; and at last, every resource being exhausted, no expedient was left him to provide against future emergencies. In this forlorn condition the balloon rose through thick clouds, and afterwards sunk; and the car, having struck against the ground with a violent impulse, rebounded from it to a considerable altitude. The fury of the storm dashed him against the mountains, and, after many rude agitations and severe shocks, he was reduced to a state of temporary insensibility. On recovering from his perilous situation he reached Mont Tonnerre in a storm of thunder. A very short period after this his anchor hooked in a tree, and in nine hours and a half, after a voyage which had nearly proved fatal to him, he landed at the distance of three hundred miles from Paris.

1809.—Blanchard died, after making sixty-six ascents.

1811.—On October 7 of this year Mr. Sadler, accompanied by Mr. Burcham, ascended at Birmingham at 2.20 P.M., and by 4 P.M. had made a rapid flight of 112 miles. The direction was at first north-east; they could at one glance behold Lichfield, Coventry, Tamworth, and Atherstone. When approaching Leicester they perceived the wind was carrying them due east, to Market Deeping. Near this they attained their greatest elevation

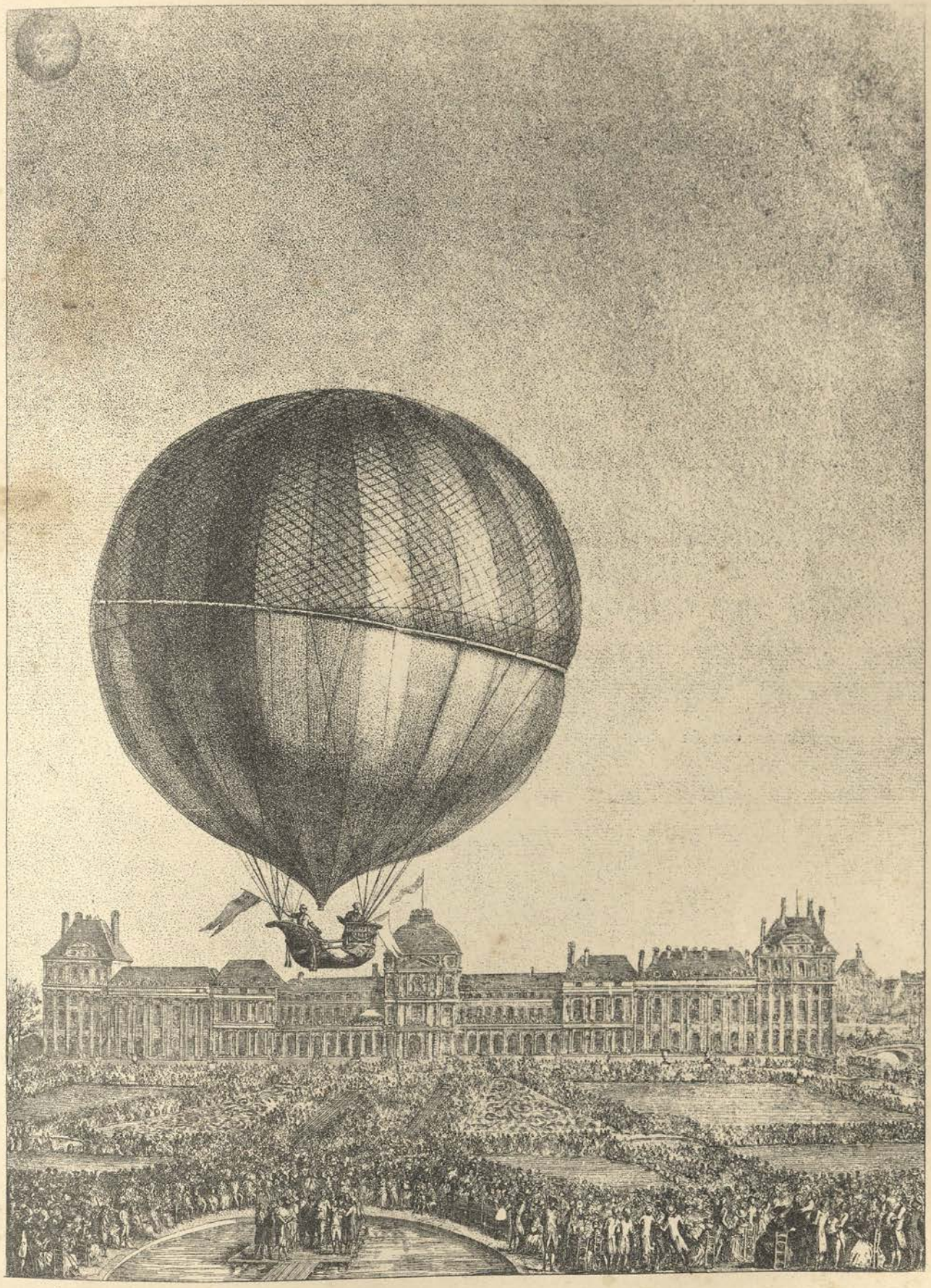

Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt. H. Belshaw James R.E. Col. Sir H. James R.E. F.R.S. &c. Director.

1864

(2½ miles), from whence they saw the towns of Peterborough, Stamford, Wisbeach, Crowland, &c. Perceiving the lower current was toward the north, Mr. Sadler descended, and alighted near Boston.

1812.—The first attempt to cross the Irish Channel was made by Mr. Sadler, who, on the 1st October, 1812, ascended from the lawn of Belvedere House, Dublin, in presence of a great multitude, receiving his flag from the Duchess of Richmond, and the military bands playing. In the account published the following poetical description is quoted from Darwin: –

So on the shoreless air the intrepid Gaul,
Launch'd the vast concave of his buoyant ball.
Journeying on high, the silken castle glides,
Bright as a meteor through the azure tides;
O'er towns, and towers, and temples wins its way,
Or mounts sublime, and gilds the vault of day.
Silent with upturn'd eyes unbreathing crowds,
Pursue the floating wonder to the clouds;
And flush'd with transport, or benumb'd with fear,
Watch as it rises the diminish'd sphere.
—Now less and less—and now a speck is seen;
And now the fleeting rack obtrudes between.
The calm philosopher in ether sails,
Views broader stars and breathes in purer gales,
Sees like a map in many a waving line,
Round Earth's blue plains her lucid waters shine;
Sees at his feet the forky lightnings glow,
And hears innocuous thunders roar below.

His own account says:—

From my elevated situation I was enabled to overlook the ridges of the Wicklow Hills and bring within the field of vision the distant ocean. The country to the south and west of Dublin, interspersed with villages and cultivated fields; the amphitheatre of hills; the broad expanse of ocean; the bay; the small breakers beating on the islands and the rocky shore; the sails of vessels glancing in the sun; all combined presented a prospect which fancy may contemplate but words can give no adequate idea of,* and to enjoy which was in itself a reward for any hazard that might attend my undertaking. When immediately over Ireland's Eye, I perceived that a rent made at starting was extending; to reach which I was obliged to tie ropes across the lower part of the netting to form a sort of ladder, and with my neckcloth I succeeded in closing this orifice. I then entered the upper current, and was carried by it in the manner the annexed map more clearly demonstrates. On again entering the lower one I was carried to the southern shore of the Isle of Man, and in a few minutes more could have been in Cumberland, had I not desired to alight in the vicinity of Liverpool. Having full confidence in the power I possessed, from the quantity of gas and ballast, I ascended to the upper current, and, when carried by it to the north-west of Holyhead, I judged this to be a convenient angle for making for the coast of Lancashire. I descended into the lower current, passed south of the Skerry Lighthouse and across the Isle of Anglesea. At 4.30 P.M. I was abreast of the Great Orme's Head, and by aid of my glass could see the Bidston Lighthouse, beyond which I wished to alight; but in this I was disappointed; for, as the evening closed, the wind shifted to the southward, and I was driven in a short time out of sight of land. In this situation I hovered about, endeavouring to find a favourable current; but as it was now 5.30 P.M., I determined at once to descend,—a resolution in which I was confirmed by observing five vessels beating

* The Spirit of Beauty.

The Spirit of Beauty unfurls her light
And wheels her course in a joyous flight!
I know her track through the balmy air,
By the blossoms that cluster and whiten there:
She leaves the tops of the mountains green,
And gems the valley with crystal sheen.

At morn I know where she rested at night,
For the roses are gushing with dewy delight;
Then she mounts again, and around her flings
A shower of light from her purple wings,
Till the spirit is drunk with the music on high,
That silently fills it with ecstasy!

At noon she hies to a cool retreat,
Where bowering elms over waters meet;
She dimples the wave, where the green leaves dip,
That smiles, as it curls, like a maiden's lip,
When her tremulous bosom would hide, in vain,
From her lover, the hope that she loves again.

At eve she hangs o'er the western sky
Dark clouds for a glorious canopy;
And round the skirts of each sweeping fold,
She paints a border of crimson and gold,
When the lingering sunbeams love to stay,
Where their god in his glory has passed away.

She hovers around us at twilight hour,
When her presence is felt with the deepest power;
She mellows the landscape, and crowds the stream
With shadows that flit like a fairy dream;
Still wheeling her flight through the gladsome air,
The Spirit of Beauty is everywhere.—R. Dawes.

down the Channel; and entertaining the confident hope that I should meet with that prompt assistance which my circumstances would require, I opened the valve, and in a few minutes was precipitated into the sea about a mile astern of them; but, to my great mortification, I found that the vessels continued their course. Thus deserted, I was constrained to reascend, and, throwing out some ballast, the balloon sprung upwards, and I again attained an elevated station to look out for some more friendly aid.

At the time I descended the sun was near setting. Already the shadows of evening had cast a dusky hue over the face of the ocean, and a crimson glow purpled the tops of the waves, as heaving in the evening breeze they died away in distance or broke in foam against the sides of the vessels; and before I rose from the sea the orb had sunk below the horizon, leaving only the twilight glimmer to light the vast expanse around me. How great, therefore, was my astonishment, and how incapable is expression to convey an adequate idea of my feelings, when, rising to the upper region of the air, the sun, whose parting beams I had already witnessed, again burst on my view, and encompassed me with the full blaze of day. Beneath me hung the shadows of evening, whilst the clear beams of the sun glittered on the floating vehicle which bore me along rapidly before the wind.

It was a considerable time before I again observed any prospect of assistance; and as the temporary day which I then enjoyed was fast declining, and beneath me the evening, thickening into shade, would soon obscure the view, I descended lower; and it was with much pleasure I discovered a vessel, which by signals gave me to understand she intended, on my descending, to afford me aid. I, at the same time, observed two others to leeward, one of which tacked and hoisted the Manx colours. I at once formed my resolution to come down without delay, it being then near six o'clock; and accordingly permitting a part of the gas to escape, I fell between the two vessels last mentioned, the first that had attracted my attention being too distant to afford me any assistance.

As the car touched the sea, the wind, which had risen with the evening, acting on the balloon, swept it along with so much velocity that the vessel astern, notwithstanding every exertion, was unable to come up with it; my sole dependence was now therefore placed on the vessel which still remained ahead, and in order to impede as much as possible the progress of the balloon, I cast out the grappling-iron; and at length taking off the greater part of my clothes I tied them to it and sunk them, in the hopes that the increased resistance in the water might tend to retard the rapid motion with which I was dragged along through the sea, now agitated by the increasing breeze, which swelled almost into a gale. This, however, had but little effect, and I found myself reluctantly compelled to weaken the buoyancy of the balloon by reducing the quantity of gas; I accordingly opened the valve, and the car immediately sunk, being left to its own power, and incapable of floating with the quantity of ballast, the greater part of which remained unexpended. In this perilous situation I supported myself for a short time by hanging to the cane hoop; but, as the balloon resting partly on the water still presented a considerable object on which the wind acted with full force, impelling it forward with great rapidity, I was under the necessity of clinging to the netting as a last resource, and in this situation was frequently plunged under water by the rolling of the balloon, being able with difficulty to keep my head at intervals so long above the surface as to prevent suffocation; but even thus circumstanced I did not lose the recollection that, however dangerous the clinging to the balloon, it was still on it my ultimate safety must depend, and that to preserve the power of the gas was an object of the first importance. I therefore passed the valve-cord (which I still firmly held) around my arm, so as to prevent the possibility of losing it, should weakness compel me to relax my hold of the netting,—an event which was now fast approaching, as my strength was completely exhausted, and under the apprehension of which I took the precaution of passing the meshes of the net once or twice round my head, and in this state encountered the danger of drowning from the rolling of the balloon.

Immersed in the waves and entirely exhausted, it was but at intervals I caught a glimpse of the vessel, and when this occurred I was too faint to make my voice be heard so as to direct the necessary operations for securing my safety. I, however, observed that the sailors seemed fearful of coming too near, lest the balloon should get entangled with their rigging, and, availing myself of the first moment of temporary strength, I called to them, as loud as my feeble state admitted of, to run the bowspirit of the vessel through the balloon. Fortunately, my directions were heard and instantly obeyed, the greater part of the gas was immediately expelled, and the violent motion of the balloon subdued; a rope was then thrown out for me to seize on, which I was fortunate enough to do while under water, and rather instinctively than otherwise to coil round my arm at the moment when every other hold giving way I should, under other circumstances, most probably have sunk to rise no more. After being dragged through the waves for a length of way, I was at last got on board with much difficulty, after having been in the water for at least half an hour, being quite exhausted, nearly insensible, and almost lifeless,—a state in which

I remained for a considerable time. The balloon and car were next secured, the latter particularly with considerable labour, in consequence of the quantity of ballast that remained: a fact which, added to the unexpended gas, convinces me that I possessed sufficient power to have remained in the air for a very long period with ease and safety, and to have accomplished at once the passage of the Channel had not my ardent desire to reach Liverpool operated as a counteracting principle.

At the time of my second descent a circumstance took place, in itself of a trifling nature, but which for its singularity deserves to be mentioned. As the car touched the water I was surrounded by a multitude of small sea-birds, which boldly approached the balloon and attended its rapid course, as impelled by the wind it skimmed along the waves. I imagined they had been attracted to the car by the fragments of cake and bread which fell upon the water; and in this supposition I was speedily confirmed, for, growing bolder by degrees, they at length rushed upon me in a crowd, and actually carried off the remnant of provisions which remained floating on the water. On mentioning the circumstance to the sailors, I was informed that the birds were of the species designated by nautical men "Mother Cary's Chickens."

The vessel on board of which I was taken I found to be the "Victory," a herring-fisher, from Douglas, in the Isle of Man, commanded by John Lee, and bound for Liverpool, to which port our course was accordingly directed, and where we arrived in safety at a very early hour on the morning of the 2nd of October. In this city I had ever experienced the most kind and flattering attention, nor did the same warm feeling fail to exhibit itself on the present occasion. Already had the news of my arrival reached the inhabitants, and, notwithstanding the early hour, a crowd of anxious spectators had assembled to greet my landing. Wet and exhausted, I found myself unequal for the moment to meet their congratulations, and accordingly went on board the "Princess" of sixty-four guns, where I was received by Lieutenant Roche with the most polite attention, obtaining dry clothes and every accommodation which my situation required.

On the evening of the 3rd of October I arrived at Holyhead, and embarking on board the packet for Dublin, was, in the forenoon of the 4th, after a tempestuous and dangerous voyage, driven into Skerries, sixteen miles from that city, to which place I immediately set out, and on the evening of the same day was again restored to my family and to those friends whose anxious and affectionate wishes had attended my aerial journey.

'Tis not in mortals to command success;
But we 'll do more, Sempronius—we 'll deserve it.—ADDISON.

1817.—Mr. Windham Sadler, with the intention of carrying out what his father had already attempted, ascended from the Portobello Barracks, Dublin, at 1.20 P.M., on the 22nd of June, having received his flag from Lady Jane Loftus. The wind was W.S.W., and he intended to effect the passage with the utmost rapidity; yet, after passing through cloud, he rose unwittingly to an altitude of $2\frac{1}{2}$ miles. The current there was not the same, for, on descending through a snow-shower, he found himself over the Hill of Howth. Having now entered the current that was favourable, his chief care was to keep the balloon in it; and this he effected by the counteracting powers of gas and ballast. By this means his course was a direct line across the Irish Channel. "... I enjoyed at a glance the opposite shores of Ireland and Wales, with the entire circumference of the Isle of Man. A fleet of twenty-one vessels, among the many single ships, formed a striking object." He noticed also the shadow of the balloon on the water, and the beautiful colour given to the sea by the setting sun. At 6.45 he alighted a mile south of Holyhead. The evening was serenely calm, and the balloon, when anchored, remained at twelve feet from the ground, motionless. He adds, with some pride, that he was the first aeronaut who had successfully accomplished the passage of the Irish Channel.

"Sir George Cayley proposed a public subscription for the purpose of ascertaining how far the principle of balloons, supporting heavy burdens in the air, may be made useful as a medium of conveyance.

"When the subscription amounted to 1000*l.*, he suggested that an Annual Committee of seven members should be appointed, and that no experiments should be undertaken but by order of this Committee, with the advice of such engineers as they chose to consult.

"Towards the attainment of this object he himself offered 50*l.*, but did not wish any one disposed to forward it to subscribe on a larger scale, as he conceived that a greater amount might be most probably obtained in smaller sums.

"We suppose, from no further mention of the subject, that Sir George's project fell to the ground."—*Gentleman's Magazine*, 1817.

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## JACOB'S DREAM.

THE sun was sinking on the mountain-zone
That guards thy vales of beauty, Palestine!
And lovely from the desert rose the moon,
Yet lingering on the horizon's purple line,
Like a pure spirit o'er its earthly shrine.
Up Padan-Aran's height, abrupt and bare,
A pilgrim toiled, and oft on day's decline
Looked pale, then paused for eve's delicious air,
The summit gained, he knelt, and breathed his evening prayer.

He spread his cloak and slumbered—darkness fell
Upon the twilight hills: a sudden sound
Of silver trumpets o'er him seemed to swell;
Clouds heavy with the tempest gathered round;
Yet was the whirlwind in its caverns bound;
Still deeper rolled the darkness from on high,
Gigantic volume upon volume wound,
Above, a pillar shooting to the sky,
Below, a mighty sea, that spread incessantly.

Voices are heard—a choir of golden strings,
Low winds whose breath is loaded with the rose;
Then chariot-wheels—the nearer rush of wings;
Pale lightning round the dark pavilion glows,
It thunders—the resplendent gates unclose;
Far as the eye can glance, on height o'er height,
Rise fiery waving wings, and star-crowned brows,
Millions on millions, brighter and more bright,
Till all is lost in one supreme, unmingled light.

But, two beside the sleeping pilgrim stand,
Like cherub-kings, with lifted mighty plume,
Fixed, sun-bright eyes, and looks of high command;
They tell the patriarch of his glorious doom;
Father of countless myriads that shall come;
Sweeping the land like billows of the sea,
Bright as the stars of heaven from twilight's gloom,
Till He is given whom angels long to see,
And Israel's splendid line is crowned with Deity.

CROLY.

JACOB'S DREAM.

# CHAPTER VI.

REMARKABLE ASCENTS FROM 1825 TO 1840.

Alone, on a wide, wide, sea,
So lonely 't was, that God himself
Scarce seemèd there to be.—COLERIDGE.

GREEN'S SOLITARY ASCENTS — IN A THUNDERSTORM — WISE'S FIRST VOYAGE IN AMERICA — BALLOON BURSTING — EFFECTS OF ECHO — EXPLOSION OF BALLOON — MR. AND MRS. GRAHAM'S ASCENTS — LONDON TO LEIGHTON BUZZARD — LONDON TO WEILBURG — PREPARATIONS — LEAVE ENGLAND — SUNSET — CROSSING THE SEA — BELGIUM — FURNACES OF LIÉGE — MIDNIGHT — "A ROPE MISTAKEN FOR A RIVER" — "A VIOLENT CONCUSSION" — "SOUND OF RUSHING WATERS" — THE DAWN — "THREE SUNRISES" — "A SNOWY LANDSCAPE" — "THOUGHTS OF CENTRAL ASIA" — DESCENT — THE DUCHY OF NASSAU — "HIMMLISCHER SCHNAPPS" — WEILBURG — PARIS — "THE SUMMARY" — THE PARACHUTE IN SIAM — "A LETTER TO THE 'MORNING HERALD'" — MR. COCKING'S EXPERIMENT — THE ASCENT — THE FATAL DESCENT — MR. GREEN'S ACCOUNT — "OPINIONS MAY STILL VARY" — EXPERIMENTS IN AMERICA — INDIAN CHIEFS BLACK HAWK AND KEOKUK THE PROPHET — BURNING FORESTS — "AN EXPLOSION" — INTENTIONAL BURSTING — "STORM SCENE ABOVE THE CLOUDS" — ARCHIMEDES' ETPHKA, WISE'S VICTORY.

1826.—IN June, 1826, Mr. Green ascended alone from Boston, in the presence of 20,000 people, and thus describes one of the many solitary and successful voyages he accomplished.

. . . . . The balloon sailing due west passed between Swineshead and Heckington, in a direct line for Grantham, when immediately over Sir John Thorold's park; Boston resembled a mass of rubbish covering about one acre; on descending I entered another current that carried me towards Newark, and I alighted at the seat of T. E. Welby, Esq., near Bottesford. The barometer showed my greatest altitude to have been $2\frac{1}{4}$ miles.

In July of this year he made a night ascent.

At 10.15 P.M. I ascended from the Vauxhall Gardens. We kept the line of the Thames. Notwithstanding the cloudy state of the atmosphere, and being deprived of the light of the moon, I could distinctly see the earth. In Battersea and Wandsworth, where the wheat was ready for cutting, it appeared like sheets spread on the ground; the ploughed land was darker, and the trees and houses quite black; bridges with gas-lights appeared like rows of lamps resting on the water; Battersea and Putney, without them, like dark planks.* By aid of Davy's safety lamp I could observe the barometer, and, to prevent a higher ascent than three-quarters of a mile, we descended at Richmond; a horse-patrol was the only person on the spot, but on account of the dead calm further assistance was not required.

* Look upon the night:
As water does a sponge, so the moonlight
Fills the void, hollow, universal air.
What see you?—Unpavilion'd heaven is fair,
Whether the moon, into her chamber gone,
Leaves midnight to the golden stars, or wan
Climbs with diminish'd beams the azure steep;
Or whether clouds sail o'er the inverse deep,
Piloted by the many wandering blast,
And the rare stars rush through them, dim and fast,
All this is beautiful in every land.—SHELLEY.

1827.—Mr. Charles Green made his sixty-ninth ascent from Newberry, in Berkshire, under very discouraging circumstances. He was accompanied by Mr. H. Simmons, a gentleman of Reading, who was deaf and dumb. The following particulars of this tempestuous voyage are given by Mr. Green:—

The morning was very squally, yet a great number of visitants had assembled on the ground before 2 P.M.; at which hour a tremendous storm of hail, rain, and thunder occurred, the wind at the time blowing such a hurricane that the balloon could scarcely be kept down, although loaded with two tons' weight of iron, and held by the restraining strength of one hundred men.

Between 4 and 5 P.M. the clouds dispersed; but the wind continued to rage with unabated fury the whole of the evening. At 6 P.M. I stepped into the car with Mr. Simmons, and gave the word "Away!" The moment the machine was disencumbered of its weights, it was torn by the violence of the wind from the assistants, bounded off with the velocity of lightning in a south-easterly direction, and, in a very short space of time attained an elevation of two miles. At this altitude we perceived two immense bodies of clouds operated on by contrary currents of air, until at length they became united; and at that moment my ears were assailed by the most awful and long-continued peal of thunder I ever heard. These clouds were a full mile beneath us; but perceiving other strata floating at the same elevation in which we were sailing, which, from their appearance, I judged to be highly charged with electricity, I considered it prudent to discharge twenty pounds of ballast, and we rose half a mile above our former elevation, where I considered we were perfectly safe and beyond their influence. I observed amongst other phenomena that, at every discharge of thunder, all the detached pillars of clouds within the distance of a mile round became attracted, and appeared to concentrate their force towards the first body of clouds alluded to, leaving the atmosphere clear and calm beneath and around us.

With very trifling variations we continued the same course until 7.15 P.M., when we descended to within five hundred feet of the earth; but perceiving from the disturbed surface of the rivers and lakes that a strong wind existed near the earth, we again ascended and continued our course till 7.30 P.M., when a final descent was safely effected in a meadow-field in the parish of Crawley, in Surrey, situated between Guildford and Horsham, and fifty-eight miles from Newbury. This stormy voyage was performed in one hour and a half.

## Mr. Wise's Ascents in America.

1835.—Wise, the most practical of American aeronauts, has left us a lucid history of Aerostation, published at Philadelphia in 1850; from which I take the following account of his own experiments. His first ascent, from Philadelphia, is thus described:—

On 2nd May, the balloon being filled, I ordered them to let go, and before I could fairly say "Good-by, gentlemen," the aerial ship was speeding me rapidly above the reach of obstructions. Now followed a scene worthy the pen of a poet. The first second or two of the balloon's ascent caused a stillness in the immense mass of people below that seemed as though they were fixed immovably to the spot, when all of a sudden the very air began to reverberate with the shouts that followed. The multitude appeared to be as much rejoiced at the result as I possibly could be myself; and I must confess it was one of the happiest moments I ever experienced in my life; for, but a few minutes before, from the circumstances attendant, the success of the experiment for the time seemed to rest upon a very doubtful contingency—that of getting back to the inflating apparatus. Up, up I soared, almost perpendicularly, to the distance of several thousand feet, when a gentle breeze wafted the machine in a south-westerly direction—the balloon still rising—until it reached a point at the intersection of Market-street and the Schuylkil River, which is about one mile and a half from where it started. Here it became stationary, or nearly so, and just at a point where the balloon had reached an altitude equal to its ascensive power, where was also a point of two currents of air traversing each other; the one from the north-east, which wafted the machine thither, was here traversed above it by a current from the west.

Having now lost sight of the great throng of people that surrounded me at starting, and standing over a large city, at least a mile above it, solitary and alone, with a low melancholy murmuring noise rising up from it; the balloon slowly writhing and twisting, as it were, between two contending currents, causing a fluttering breeze around me, while I was standing in the car without hat, coat, or boots, looking around, below, above, and in every direction, strange emotions pervaded my mind. Grandeur had ever been a delightful theme to me, but this was more than grandeur. All the higher faculties of the human mind became gradually aroused; I was gently

awakening from a magnificent dream, casting my eyes upon a scene of reality that appeared far more grand and magnificent than the dream itself; strange feelings were passing through my mind; I felt composed in body, but there was an indescribable commotion agitating the inner man, and it was some time before I reasoned the soul and body into their natural state of equilibrium.* Although the atmosphere at this height was cold, the perspiration now began to roll from my forehead in large drops. By a comparison of the previous few hours with the present position then occupied, I became enabled to look and reflect in a more natural spirit; but still, the vastness, grandeur, and sublimity of the scene around me kept me in a mood far different from what I had ever before experienced. The mind appeared to expand itself commensurately with the magnitude of the scene that surrounded it. Here was an immense community of human beings swarming underneath my feet, sending up a humming buzz from their apparently condensed cells; there, the ample folds of the Delaware were rolling themselves into the heaven-curtained clouds of the distant horizon; above me stood the huge distended balloon, swelled, as it were, in pompous pride of its exalted position, floating like an independent sphere, with its single inhabitant, in the great ethereal ocean of the universe. It was a soul-inspiring scene, and one that will never be erased from my mind as long as its faculties shall live.

The balloon was retained in the eddy it had reached for several minutes, and until it was lightened sufficiently to rise above it, which was done by cutting off and throwing overboard a heavy flower-wreath which had been twined around the car. These flowers, as they fell from the car, were taken for birds by those who watched the progress of the balloon with telescopes, as I was afterwards informed. Besides this, the car was hanging so near the balloon, that I was enabled to detach the tin tube which was in the neck of it, and which, in this instance, was unnecessarily heavy; but, as the disposal of the wreath had lightened the machine sufficiently to enable it to rise above the eddy, I did not throw it overboard at that point, and upon consideration found it would not be safe to do so until I should get over a place where no human beings would be endangered by its descent. After the balloon had risen above the lower current, and the eddy which invariably exists between two currents, it took off in a direction eastward, nearly on a line with Arch-street. This I was enabled to tell by the map-like appearance of the city, the market-houses being in the next street south of it, which made a good mark to distinguish the streets by. As I passed slowly over the city, its murmuring noise rose up in modulations of variable intensity, giving it a melancholy musical effect, in some measure resembling the sound of an Æolian harp. The current from the west being very gentle, it required full twelve minutes to carry the machine from the Schuylkil to the Delaware, during which time I feasted my eyes upon the panoramic scenery of the city and its precincts, occasionally running the eye along the serpentine folds of the Delaware to where it was lost in the clouds which skirted the horizon all round. The Schuylkil seemed of too little interest, when viewed from that height, in comparison with its larger neighbour.

When I reached the Delaware I threw overboard the neck-pipe of the balloon, which made a rushing sound in its descent until it splashed into the water, which I heard distinctly, although I was over a mile above its surface. As I crossed the Delaware, the view up and down for a distance of twenty or thirty miles each way was picturesque and grand beyond conception, and yet more natural in appearance than land scenery. This effect of the river scenery caused a degree of composure in my mind, which, until now, had been strained far beyond a normal condition, that enabled me to investigate and observe in a more ratiocinative manner. Before this, amazement was the only resultant of all observation on this magnificent planisphere. Although the boats and ships on the river looked very diminutive, still the scene had the miniature appearance of a natural reality. This was not the case in taking a grand and general view over the whole visible plain beneath; for, in such an observation, a regularity and exactness developed itself in the scene, which gave it more of an artificial than a natural aspect. A perfectly formed circle encompassed the visible planisphere beneath, or rather the concavo-sphere it might now be called, for I had attained a height from which the surface of the earth assumed a regularly hollowed, or concave appearance,

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* O Nature! by impassion'd hearts alone
Thy genuine charms are felt. The vulgar mind
Sees but the shadow of a power unknown:
Thy loftier beauties beam not to the blind
And sensual throng, to grovelling hopes resign'd:
But they who high and lofty thoughts inspire,
Adore thee, in celestial glory shrined,
In that diviner fane, where love's pure fire
Burns bright, and genius tunes his loud immortal lyre.—PRINGLE.

an optical delusion which increases as you recede from it. At the greatest elevation I attained, which was about a mile and a half, the appearance of the world around me assumed a shape or form like that which is made by placing two watch crystals together by their edges, the balloon apparently in the central cavity all the time of its flight at that elevation; the river each way, cut off at the intersection of the upper and lower concavo-spheres. At one time this crevice, if I may so term it, was apparently filled in with clouds all-around, while at the close of the voyage the visible horizon was clear of them, which gave it, as I before stated, a very artificial appearance. I could not help thinking at the time that, had the Roman Inquisition which made Vincent Galileo recant his doctrine of the rotundity of the earth, in favour of the planispheric theory, occupied my position, they would have insisted to his swearing that our earth was hollowed or concave on its outer surface, instead of flat, as they made the philosopher swear it was.

After I had crossed the Delaware and reached a point five or six miles on the Jersey side of it, I made preparations to descend, as I discovered the balloon was now gradually sinking from the loss of gas through its imperfection, which made me feel as sorrowful as Adam when he was expelled from the garden of Eden. After being in the upper regions of the atmosphere one hour and a quarter, I made a safe descent near Haddonfield, a village about nine miles distant from Philadelphia, and returned home that evening, where I received the congratulations of many friends.

Now that I had really enjoyed the pleasures of an aerial voyage,—viewed the earth from a point in space which was isolated and unobstructed; feasted my eyes upon one of the most interesting and richest scenes that mortal man could imagine; and had acquitted myself in an experiment publicly announced in a creditable manner,—it might have been supposed that my desires and ambition in this matter had been fully satisfied. But such was not the case. I had now visited the shrine of intellectual grandeur, and its attractions were seductive. I had dreamed a magnificent dream, which, I felt convinced, could be realised. Such were my reflections when recurring to this event. Although many of my friends desired me, in the most persuasive manner, to give up the idea of repeating the experiment, looking upon it as an extremely dangerous business, I resolved in my own mind to pursue it as long as it afforded me the same enjoyment which I experienced in my first essay. Besides, I formed an opinion that aerial navigation was destined to move with the progressive order of the day; and I felt that a duty devolved upon me not to let it sleep for the want of active investigation, however slow its improvement might be. Such considerations induced me to go on; and on I did go, as the sequel will show, for fifteen years already, with, at least, well-founded hopes of its approaching general usefulness, if not with considerable improvement in the way of having simplified the art, so as to bring it within the reach of experimenters at a reasonable cost and a certainty of success that must ere long give it a valuable feature.

## Another ascent was made in July, from Lebanon, Pennsylvania, when the weather was extremely warm.

There were (he says) defects in the rigging of the balloon which developed themselves in the high and rarefied regions of the atmosphere, that placed me for a while in a very perilous situation.

At 3 o'clock P.M. I left the earth with a breeze from the north-west. In a few minutes after, a panoramic view of innumerable villages, with the broad dazzling sheet of water of the Susquehanna, was unfolded to the view. I crossed the Reading and Harrisburg turnpike at the first gate below the town, and although I started off with an ascending power that raised me more swiftly than was the horizontal velocity of the wind, I was induced to part with a bag of sand of about six pounds' weight, as a proffer to the toll-gate keeper, who very humorously hailed me to pay toll as the balloon passed over his gate. This caused the balloon to rise with amazing rapidity rushing up through the strong horizontal wind, which was blowing with a speed of at least thirty miles per hour, and giving the occasion much the appearance and spirit of that in which a fiery charger is dashing along in mettled pride, heeding no restraint. This soon brought me in contact with a thick hazy mist, which was entered and in a few moments passed. Above this were a clear sky and brilliant sunshine; but it was now so cold that my hands became numb, and a painful earache seized me. The balloon was still ascending rapidly, and my next impulse was to discharge gas and descend into a more congenial climate; but in this I was foiled, and up boomed the buoyant courser with unabated career. The cord by which the valve was worked was sufficiently strong to perform that office, but no allowance was made in its appropriation to unforeseen necessities—such as slight entanglements with other

parts of the balloon rigging—getting into folds of the flaccid part of the balloon—which latter liability occurred on this occasion, and deprived me of the use of that all-important regulator.

Having now got far above the mist, and not less than three miles above the earth, in a temperature of 43°, having been within twenty-five minutes transferred from a warmth of 94°, which the thermometer indicated when I left the earth,—the world below scarcely visible from the intervening discoloured stratum of air; my ears buzzing like a bee-hive, which for a while I took to be a commotion of the gas in the balloon endeavouring to escape through its tightly distended envelope; the valve-rope broken off inside the machine; the aerial ship still bounding and gyrating upwards,—I felt a degree of excitement that can be better imagined than described.

All this difficulty arose from a want of practical knowledge in the art which must be acquired in this, as in any other business, before we can avoid consequences arising from such deficiency. In the first place, the valve-rope was too frail in this machine; instead of a substantial cord (cod-fish line I find the best), this was only common seine twine. The car was also rigged too near the balloon; this may have been observed already by the intelligent reader, where it is mentioned in the account of the first voyage, that the car was so near the balloon that I was enabled to untie the neck-pipe in the lower orifice of it. On this occasion I had it hanging at least three feet lower from the balloon than before; but when I got to a height in the atmosphere where the gas sustained but half the pressure it did at the time of leaving the earth, it naturally dilated accordingly, and all the part of the balloon that was flaccid when it started was now required for its increase of bulk. For this increase the space within the cords and network between the equator of the balloon and the concentrating hoop above my head, to which the car was hanging, was insufficient. Having no way to let off gas,—even the lower orifice of the balloon containing the neck-pipe, which answers for a safety-valve when properly rigged, was doubled up between the concentrating hoop and the lower side of the balloon, which was now swollen to its utmost tension,—I endeavoured to reach the lower part of the balloon with a knife, but, by straddling across with my feet in the open-work of the basket, it could not be reached by at least two feet. From the hissing noise of the gas which was making its way through the small channels of the compressed neck of the balloon, I knew that something must give way soon. As I did not know at that time that so large a surface of fabric as is contained in a machine of that size would inevitably meet with friction enough, in falling through the atmosphere, to bring it to a velocity where an acceleration must cease, and *that* at a point where its speed will not cause serious consequences from contact with the earth, I was apprehensive that it *might* be my last voyage.

In another moment a report like that of suddenly bursting an inflated paper-bag, such as boys frequently amuse themselves with, informed me that the balloon had rent; and, at the same time, some of the cords—two of them—separated from the concentrating hoop; and that side of the balloon at which this took place as quickly bulged out, and immediately the atmosphere round the machine got filled with a whitish filmy vapour. This was the consequence of a mixture of warm hydrogen with cold atmosphere. The hydrogen in a balloon is always warmer than the surrounding air, when the sun is shining on its globular surface. The explosion was caused by the neck-pipe being pressed between the concentrating hoop and the lower surface of the balloon, and this pipe being tin, and pressing also against two of the net-cords which were brought to an angle by being forced out a little by the muzzle of it, caused them to break at the same time. Although the breaking of two cords next to each other out of the twenty-four—which was the number in this machine—did not seem to endanger my situation much, but seemed rather to have relieved me to some extent from the very precarious condition in which I had been a few moments previously, it still destroyed that mathematical strength existing in its complete state, which made me feel anxious to return to *terra firma*. I looked at my watch, and found the time to be five minutes past four.

After the explosion of the lower part of the balloon, it commenced a tolerably rapid descent, and as the atmosphere had got considerably clearer than it had been when I started, I could more easily distinguish the face of the country beneath. On observation I found the balloon was gradually descending on the village of Womelsdorf. Here I received a salute from a volley of musketry, by a company of volunteers who were celebrating the National Republican birthday at that place. Although I had determined to let the balloon sink to the ground as soon as it possibly would from its own gravitation occasioned by the loss of the gas through the rent, for I had no control of the valve, this salute of firing and shouting inspired me to rise again; and accordingly papers and ballast were thrown overboard, sufficient to send the machine up at least two miles high. No sooner was this height attained, than it again commenced to descend very gradually, which brought me to the earth about four miles west of Reading. Here an incident occurred which was as amusing to me as it was terrifying to the individual who was a party thereto. Being likely to descend in a cluster of trees, I threw out some ballast to cross them—at the same

time the grappling-hooks took hold in a branch of one of the trees, which was broken off and dragged along. At this moment I perceived a countryman mounting the top rail of a worm-fence about a hundred paces ahead of the balloon, to which point the wind was driving it. I hailed him to assist, for the balloon was floating the length of the grapple-rope above and dragging the limb of the tree along below. He looked in every direction but upwards, and in another moment the limb and grapple came square up against the panel of fence upon which he was sitting, and threw it down, pitching the man head foremost into the meadow before him, from which he sprang terror-stricken, if fleetness of foot is any evidence of such feeling, for he was soon out of sight, leaving me to manage the best way I could, which was by being driven up against a wood. Here I got the assistance of two women who had been working in the hay-field, and who promptly came to my assistance when I called them, although they were much excited, having never seen such a contrivance before, as they informed me. Had it not been for these Amazonian ladies, I should inevitably have gotten into the wood, for a brisk gale was just passing over at the time.

Thus ended a voyage, after having been in the atmosphere one hour and a half, full of interest, excitement, and a great deal of instruction. So far were these difficulties from discouraging me, that they, upon the other hand, dictated me to go on and perfect the deficiencies in my apparatus.

On the 1st October he made an ascent from Lancaster, and thus describes it:—

In about two minutes after I entered the cloud stratum, the balloon emerged from the top. Just as it was penetrating the upper surface of the stratum, I found the cloudy vapour quite warm, and immediately, on emerging from it, this warmth was increased to a degree of temperature above that of comfortable feeling. A pungently stinging sensation was also produced upon those parts of my person which were exposed to the sun's rays. This I attributed to the hydrogen, which was let off while passing through the clouds, some of which hung to me in passing through it. Having started with considerable ascensive power, and having nearly one hundred pounds of ballast in the car, a considerable quantity of gas was discharged while passing through the clouds, which was intended to counteract, in a measure, the *increased* ascending velocity the balloon would attain, as soon as she would get under the direct influence of the sun's rays, above the stratum. Notwithstanding this precaution, as soon as the barrier was passed, the balloon, in a few moments after, sped up at a furious rate, until it reached a height at which the barometer stood at 19 inches, and the clouds appeared at an immense depth below me. Not experiencing much warmth by the reflection of heat from the clouds at this distance above them, and the balloon, now moving in an angular direction to that of the clouds, their upper surface lit up in a brilliant white light, gave it the appearance of a vast circular ocean of snow, rolling along in a wavelike motion, in the most majestic grandeur, and the cold frosty state of the atmosphere, from which it was beheld, rendered this *snow scene* most impressive.

I next discharged gas until the barometer stood at 23 inches. At this height, it being but a short distance above the cloud surface, I found the temperature very congenial, and continued the rest of the voyage, varying by barometer from 23 to 22 inches. In the rise and fall of the balloon above the clouds, which occupied twenty minutes, it described a spiral circle; and, on coming near to the surface of the clouds, I recognised a familiar tune of martial music, which I afterwards learned was the very tune played by the musicians of the city battalion of volunteers, who on this occasion formed a cordon around the ascension ground, they being invited to attend and participate in the enjoyment of the spectacle. An opening in the clouds which occurred for a moment also developed to me a watercourse below, which I took for the Conestogo. My course now lay, as near as I could judge, towards the south; but, in order to be more certain concerning my whereabouts and direction, discharged gas and darted down through the clouds; but when below them, the country appeared so rough with forest hills, and the space between the hills and the lower cloud surface so shallow, I quickly threw out some ballast, which sent me up again partly into the clouds. Hearing a cowbell and the sounds of a wood-chopper's axe, I hailed in the following manner: "Halloo!" to which I heard the reply, "*Halloo!*" I next inquired, "How far is this from Lancaster?" which in a few moments was returned by "*How far is this from Lancaster?*" Believing this to come in response as an inquiry to know whether I wished to learn that fact, "the distance to Lancaster," I repeated it again in very measured accent. This was again responded to in like measured accent, apparently to my mind with an intent of mockery. Being in the clouds, and not able to see things either above or below, I felt somewhat nettled at such clownish display of wit; and in a very audible tone of voice, while the foregoing was still reverberating on my ear, sung out, "You are a fool!" which in a very few seconds was

answered in an equally distinct and measured tone of, "*You are a fool!*" when it suddenly flashed upon my mind that it was the echo of my own voice, which opinion was ratified by the dying reverberations of "You are a fool," which had now become as numerous as though a whole regiment had caught the watchword and were passing it in quick succession through the whole line. Involuntarily I exclaimed to myself, "Fooled, sure enough." Being determined to find out my whereabouts, I let off sufficient gas to get below the clouds, when I observed through a spy-glass a little clearing in which was a cottage, and before it a man. His face was turned upwards, apparently drawn in that direction by the dialogue I had with myself, and which no doubt he had heard. I inquired of him whether he saw me, for I was then standing up in the car and waving a flag to draw his attention. He answered, "Yes; who are you?" I replied, "An angel of light." Upon which he cried out, "Is your name Wise?" To this I responded, "Yes; how far is this from Lancaster?" To which he answered, "Sixteen miles." Upon which I bid him "Good-bye," threw out some ballast, and went up through the clouds again. As I was passing up I heard him say, "God bless you, man."

Having now become interested in this singular phenomenon of echo, I continued making experiments in it. I found when sailing some hundred feet above the cloud stratum, that the echoing sound was short, not near so sonorous or musical to the ear as when in the clouds or immediately beneath them. Still I could hear the reverberations until they became blended into mere undulatory sounds. When at a considerable elevation above the clouds, one or two thousand feet, I could discern no echo, and the report of a rifle was short and sharp; so also the sound of a bell, and the chopping of an axe. From these experiments, I think one loud clap of thunder occurring when a dense stratum of clouds is extended over a great portion of surface, is sufficient to cause that long continued rumbling thunder which we often hear, one echo inducing another, until by multiplication they become so numerous as to blend into a mere rumbling vibration in which it is neutralised and lost, as are the waves which are caused by throwing a stone into water.

The wind just above the cloud region appeared to be vibrating from various points of the compass, causing the balloon to describe a kind of zigzag course in a southerly direction, necessarily making the progress in that direction somewhat slow for aerial travelling.

Knowing my course would carry me on to the bay shore, and having been aloft nearly two hours, it was evident that I must be nearing the Chesapeake, unless the balloon was making a different course from that of her first sixteen miles. Consequently another gradual descent through the cloud stratum, which was still very dense, was made, which brought the machine over Conewingo Falls in the Susquehanna River. The roaring noise as it met my ears, while yet in the clouds, gave me some foreboding that I had reached the bay shore, taking the noise of the falls for that of the bay surf. My anxiety was relieved from this, and increased in another quarter; for, in coming through the clouds, the falls were immediately underneath me, the balloon descending very rapidly, and the opposite side of the river lined with highlands and trees, and it was not until a great quantity of ballast was discharged that the balloon overcame the obstacles. I hailed some individuals living at the falls, who invited me to descend and partake of their hospitality, which, however, the position I was placed in compelled me to decline. Before I made this reconnoissance, the sun was near the horizon above the clouds, and when my vessel got below them I found the earth shrouded in a gloomy twilight. The Chesapeake lay some miles to the south, and the direction the balloon was making would carry it along its western border. The large quantity of ballast discharged in crossing the falls, caused the balloon to rise to a great height above the clouds, bringing, as it were, the sun above the horizon also, which but a few minutes before was sinking behind a bank of clouds, and had now become elevated twelve to fifteen degrees. This phenomenon interested me more than it deceived me, but was still the cause of keeping me aloft until it had got dark below, which circumstance cost me my balloon and a most terrific accident.

Seeing now, at even that height, that the day-god was fast sinking in the cloud horizon, I commenced a gradual descent, and before I reached the upper surface of the clouds the sun was lost behind their western bound. The descent through this vaulted ceiling of the earth was dark and gloomy in the extreme. A deathly silence, equalled only by the impenetrable darkness that surrounded me on all sides, made the descent awful, and yet grand and imposing. As soon as the clouds were cleared, a few scattered lights were visible, which apprised me that I was coming on land, and in a few moments after I felt my drag-rope, which was four hundred feet long, glide gently over tree-tops, and in a few moments more I felt, by its motion, that it was dragging apparently over smooth ground; and, hearing at the same time human voices not far off, the grapple-iron was immediately thrown out, which as quickly brought up the vessel near a fence. Having hallooed considerably while descending from the clouds to the earth, and hearing no response, I next betook myself to loading my car with stones which

were within my reach. Having accomplished this in a manner sufficient to keep the balloon anchored by the car in case the grapple-iron should slip its hold, I commenced hallooing again, which was immediately answered by a coloured man, as I judged from his dialect. He cried, "Where are you?" I answered, "Here, with a balloon." He replied, "I know dat." This surprised me, and I cried out, "How do you know it?" He answered, "I smell de balloon." This surprised me still more; but he having in the mean time come up to me, informed me, upon inquiry, that he had helped to fill a balloon at Baltimore the fall previous; and that as soon as I told him I was there with a balloon, he concluded I had come from Baltimore with one, having no doubt of what I told him, because he smelled the hydrogen. Uneducated man as he was, I found him one of remarkably quick perceptive faculties, and just such an one as an aeronaut is glad to meet with on his descent. He informed me that I had landed between Belle-Air and Port Deposite, on the plantation of Mr. Stump, in Harford county, Md. By his assistance the balloon was moored near the house of Mr. Stump, when we roused the family, they having retired to bed at an early hour. Here we found plenty of assistance, Mr. Stump giving me a very cordial reception, at the same time ordering his coloured men to render me all the assistance necessary. As it was drizzling, and the grass was wet, I determined to discharge the gas from the upper valve of the balloon, and thus be enabled to fold the whole machine into the car beneath it, as it gradually collapsed. This process being necessarily slow, and the atmosphere very humid, it became impregnated with the hydrogen for some distance around the balloon. Being some distance from the house, and having a lantern standing at least fifty feet from the balloon, I apprehended no danger from the escaping gas. Things went on in this way until the balloon was emptied to within a thousand cubic feet of gas, her upper end being now drawn down, and one of the men with his hand pressing open the upper valve, while I was standing at the other end carefully folding the loose silk into the car. While thus engaged, Mr. Stump standing about thirty feet behind me, and some half-dozen more persons near and round the machine, either the lantern, or some other light which had in the mean time been brought to the scene, ignited the explosive mixed atmosphere that was hovering around the balloon, making a report like a park of artillery, throwing me violently back at least ten feet from the place I was standing, setting fire to the clothes of some, and severely scorching the faces and hands of others, and even Mr. Stump did not entirely escape the effects of it, although a considerable distance from the machine.

I quickly sprang upon my feet again, and jumped on to the remainder of the balloon which was burning in the car, and which was thus extinguished by tramping it out—the gas that had by the sudden explosion been liberated from the balloon, in the mean time rose rapidly into the air "like a consuming fire," with a rushing noise, until, at a considerable height, it was totally consumed like a dying meteor.

There I stood in deep reverie, scarcely able to realise the events of the last few hours, with feelings like a person awakening from a dream, in which all the magnificence—sublimity—solemnity—terror—consciousness of approaching death, that the human mind is capable of conceiving, agitating my thoughts. For, at the moment of the explosion, the death-pang flitted through my mind. In a few moments I was aroused from my fixed position by an agonising pain through my whole body, which soon concentrated itself in my hands and face. I felt as though the very heart's blood was oozing through the skin, and I was soon made sensible that I was wofully scorched in those parts—the watery fluid of the system was oozing out in profuse drops, and some of the poor negroes had fared no better than myself in this respect, which their agonising screams too plainly told. Mr. Stump, who was more of a spectator than an immediate sufferer in this terrific affair, being a very considerate gentleman of advanced years, came up to me and desired me to accompany him to the dwelling, for, by this time, I had become almost blind. . . . .

Medical assistance was obtained, but it was some time before he recovered.

### Ascents of Mr. and Mrs. Graham.

1836.—Mr. Graham had commenced experiments in aerostation in 1823, and Mrs. Graham in 1824. I cannot find anything very remarkable to record of them during this long period, except the extreme boldness of the latter in ascending frequently alone, and on one occasion with another lady (Mrs. Cheese); but in this year she met with a serious accident when descending from a high flight with the Duke of Brunswick. This did

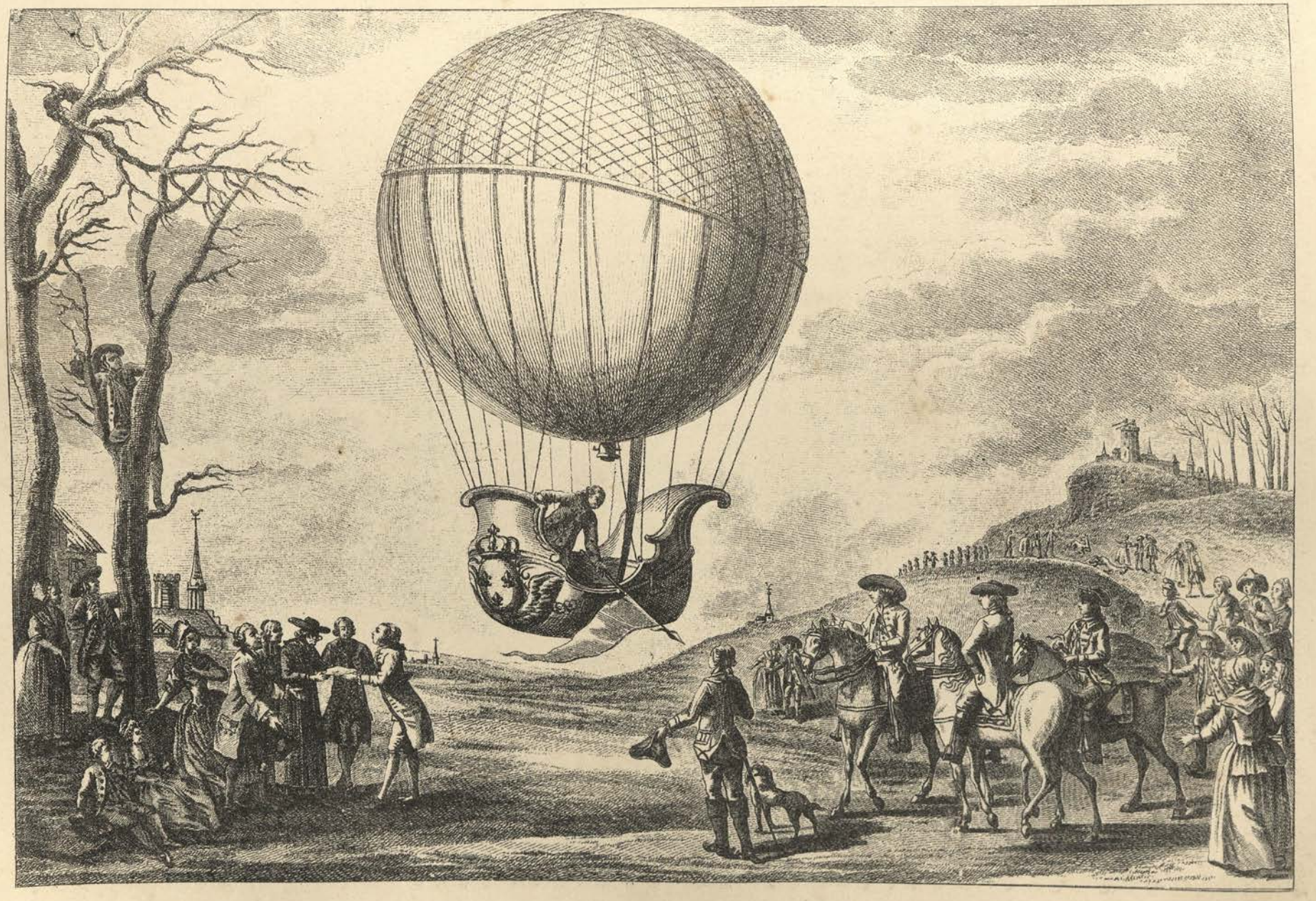

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c.Director.*

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not, however, deter her from resuming her experiments. Of one of Mrs. Graham's ascents a poet thus wrote:—

1.

Lo, while sublimely borne upon the gale,
Our fate to watchful Providence consign'd,
O'er the blue ether's wide expanse we sail,
And leave for brighter realms the world behind:

2.

As, far beyond the glance of mortal eye,
While gentle zephyrs waft our floating car,
We urge our fearless voyage to the sky,
And trace the mystic wonders of the air.

3.

A mighty region all around us grows,
No human skill may its confines explore;
The Pow'r that fram'd, alone its limits knows,
Where time, and space, and nature are no more.

4.

Here while our silken sphere serenely glides,
The distant earth fades in the awful vast;
We gaze admiring o'er the aerial tide,
And the last vestige of the world is past.

5.

Beneath us far the floating clouds appear
In heaps on heaps of misty vapours roll'd,
Like distant mountains rising on the air,
And all the boundless horizon unfold.

6.

As if Omnipotence had form'd a veil,
When erring man forgot His sacred reign;
That might from sight of Heav'n a world conceal,
Where oft His bounteous gifts are giv'n in vain.

7.

And as we gaze we own that Power supreme
Who thro' the realms of air our course protects,
Who by His mandate did their wonders frame,
And Nature's latent mysteries directs.

8.

No bold presumption now impels our flight,
For while these mysteries we would explore,
Where scenes celestial open on our sight,
We bend in rev'rence, and His name adore

9.

Whose wisdom gave them being, and whose eye,
Still watchful o'er the creatures of His word,
Looks down in mercy from His throne on high,
And suppliant nature owns th' Almighty Lord.

10.

Oh, might we still thro' this bright region soar!
But this eternal Providence denies;
Thus far we can—His will permits no more,
And we reluctantly forsake the skies.

11.

But still, this much to Graham's hopes is giv'n,
No aerial voyagers could venture more;
And still our fate, the care of fav'ring Heav'n,
We reach in safety the terrestrial shore.

This year also Mr. Monck Mason made an ascent from Vauxhall, which is thus described in a letter—

To the Editor of 'The Times.'

Sir, October 18, 1836.

Perhaps I ought to apologise to you and your readers for so soon troubling them upon the same subject, and one which, from the frequency wherewith it has been treated of late, may very reasonably be considered as almost exhausted. The great variety, however, of the aspects under which Nature exhibits herself in such situations, and the novelty of the manner in which even her most ordinary features are displayed to those who avail themselves of such a mode of examining them, will at all times leave room even for the most superficial observer to make some remarks which have escaped the comments of former aeronauts, and to note some peculiarities which distinguish each successive ascent from all those which have preceded it. Scientific experiments are, of course, out of the question in an ascent which has not been conducted with an especial view to such ends, and where the elevation attained (which is, in fact, the chief grounds for its employment in such purposes) was not calculated to admit of any beyond those of the most usual and commonplace description. So manifold, however, are the operations of Nature, and so replete with interest even the most insignificant of her works, that no two ascents can ever be said to be so perfectly alike that something may not remain to be told to interest the general reader, and excuse the recurrence of a subject which must yet, for a long period, continue to be classed among the most striking novelties of an enterprising age.

At twenty-five minutes to four our balloon and car, containing nine persons, rose majestically from the ground, and, assuming at the first a south-westerly direction, rapidly traversed the extremity of the firework

gallery, immediately and closely sweeping over the heads of the persons who had collected there for the purpose of witnessing the ascent. As soon, however, as she had reached a slight elevation her ascensive power quickly prevailed, and in a few seconds she was involved in the clouds which impended at a slight distance above the surface of the earth.

Although the day might be considered as generally unfavourable to aeronautical display, yet was it not without its advantages, especially to those whose previous experience in such scenes had been confined to a clear atmosphere or an unclouded sky. The vast extent of vapour which canopied the earth and ultimately excluded that object from our view, if in one point it was calculated to detract from the beauty of our prospect, by depriving us of one great and usual source of admiration, in another contributed to the interest and majesty of the scene by the novel aspect under which it presented the altered face of nature to our senses.

Scarcely had we quitted the earth before the clouds, which had previously overhung us, began to envelop us on all sides and gradually to exclude the fading prospect from our sight. It is scarcely possible to convey an adequate idea of the effect produced by this apparently trivial occurrence. Unconscious of our own motion from any direct impression upon our own feelings, the whole world appeared to be in the act of receding from us into the dim vista of infinite space; while the vapoury curtain, like similar phenomena represented on the stage, seemed to congregate on all sides and cover the retreating masses from our view. The trees, the buildings, the spectators and their crowded equipages, and finally, the earth itself, at first distinctly seen, gradually became obscured by the thickening mist, and growing whiter in their forms, and fainter in their outlines, soon faded away "like the baseless fabric of a vision," leaving us, to all appearance, stationary in the cloud that still continued to involve us in its watery folds. To heighten the interest and maintain the illusion of the scene, the shouts and voices of the multitude whom we had left behind us, cheering the ascent, continued to assail us (long after the interposing clouds had effectually concealed them from our eyes) in accents which every moment became fainter and fainter, till they were finally lost in the increasing distance.

Through this dense body of vapour, which may be said to have commenced at an altitude of about 1000 feet, we were borne upwards to perhaps an equal distance, when the increasing light warned us of our approach to its superior limits, and shortly after the sun and we rising together, a scene of splendour and magnificence suddenly burst upon our view, which it would be vain to expect to render intelligible by any mode of description within our power: pursuing the illusion which the previous events had been so strongly calculated to create, the impression upon our senses was that of entering upon a new world to which we had hitherto been strangers, and in which not a vestige could be perceived to remind us of that we had left, except the last faint echo of the voices which still dimly reached us, as if out of some interminable abyss into which they were fast retreating.

Above us, not a single cloud appeared to disfigure the clear blue sky, in which the sun on one side, and the moon in her first quarter upon the other, reigned in undisturbed tranquillity. Beneath us in every direction, as far as the eye could trace, and doubtless much farther, the whole plane of vision was one extended ocean of foam, broken into a thousand fantastic forms; here swelling into mountains, then sinking into lengthened fosses, or exhibiting the appearance of vast whirlpools; with such a perfect mimicry of the real forms of nature, that, were it not for a previous acquaintance with the general character of the country below us, we should frequently have been tempted to assert without hesitation the existence of mountainous islands penetrating through the clouds and stretching in protracted ranges along the distant verge of our horizon.

In the centre of this hemisphere, and at an elevation of about 3000 feet above the surface of the clouds, we continued to float in solitary magnificence, attended only at first by our counterpart—a vast *image of the balloon* itself with all its paraphernalia distinctly thrown by the sun upon the opposite masses of vapour, until we had risen so high that even *that*, outreaching the material basis of its support, at length deserted us; nor did we again perceive it until, preparatory to our final descent, we had sunk to a proper elevation to admit of its reappearance.

Not the least striking feature of ours and similar situations is the total absence of all perceptible motion, as well as of the sound which in ordinary cases is ever found to accompany it. Silence and tranquillity appear to hold equal and undisputed sway throughout these airy regions. No matter what may be the convulsions to which the atmosphere is subjected, nor how violent its effects in sound and motion upon the agitated surface of the earth, not the slightest sensation of either can be detected by the individual who is floating in its currents. The most violent storm, the most outrageous hurricane, pass equally unheeded and unfelt; and it is only by observing the retreating forms of the stable world beneath that any certain indication can be obtained as to the amount or violence of the

motion to which the individual is actually subjected. This, however, was a resource of which we were unable to avail ourselves, totally excluded as we were from all view of the earth, or any fixed point connected with it.

Once and only once, for a few moments preparatory to our final descent, did we obtain a transitory glimpse of the world beneath us. Upon approaching the upper surface of the vapoury strata, which we have described as extending in every direction around, a partial opening in the clouds discovered to us for an instant a portion of the earth, appearing as if dimly seen through a vast, pictorial tube, rapidly receding behind us, variegated with furrows and intersected with roads running in all directions; the whole reduced to a scale of almost graphic minuteness, and from the fleecy vapour that still partially obscured it, impressing the beholder with the idea of a vision of enchantment, which some kindly genius had, for an instant, consented to disclose. Scarcely had we time to snatch a hasty glance ere we had passed over the spot, and the clouds uniting gradually concealed it from our view.

After continuing for a short space further, in the vain hope of being again favoured with a similar prospect, the approach of night made it desirable that we should prepare for our return to earth, which we proceeded to accomplish accordingly.

It is in the management of the descent under circumstances similar to those which characterised the present occasion that the utmost skill of the aeronaut is principally displayed. The low position of the clouds, resting almost upon the earth itself, precludes the possibility of observing the nature of the ground until it would, without the exercise of the greatest judgment, be impossible to avoid completing the descent, however unfavourable the country might eventually prove for such a purpose. To all this detail, however, Mr. Green proved himself perfectly competent; the balloon gradually descended into the cloudy region below us, and became involved for a minute or two in obscurity ere we perceived ourselves slowly emerging over a large tract of ploughed land particularly well adapted to our design. Scarcely had another minute elapsed before the grapnel reached the ground, on which it continued to drag with some resistance for a short space until it took a firmer hold of the soil; when two gentlemen (one of them Mr. Cumberlege, the clergyman of the neighbouring district), who were riding with some ladies, perceiving our situation, leaped from their horses, and with a zeal which merited our thanks lent their aid to secure the grapnel more firmly. More persons shortly after arriving, the balloon was finally brought to the earth, and we effected our landing in a common called Billington Fields, in the parish of Leighton Buzzard, about two miles beyond that town and about forty-eight from the Gardens at Vauxhall; having employed about an hour and three-quarters in the voyage, upon a nearly uniform course of north-west by north, and at a nearly uniform elevation of about 5000 feet above the level of the sea.

M. M.

We come next to the flight

## From London to Weilburg in the Great Nassau Balloon.

Mr. M. Mason gives the following account in his 'History of Aerostation' (1837), of the most remarkable trip that has to this day been effected:—

Mr. Robert Hollond, a gentleman who had long cultivated a practical acquaintance with the art of aerostation, resolved to afford an opportunity for a full display and unequivocal determination of the merits of these discoveries, by undertaking, at his own expense, to fit out an expedition, under the guidance of Mr Green (in which he was so kind as to include me), for the purpose and with the intention of starting from London and proceeding (in whatever direction the winds at the time prevailing might happen to convey us) to such a distance as would suffice to answer the ends for which the voyage was especially designed. In order to give the fullest effect to such an undertaking it was necessary to be provided with a balloon of size and structure superior to those employed upon ordinary occasions. Arrangements were accordingly entered into with Messrs. Gye and Hughes, the proprietors of Vauxhall Gardens, for the use of their large balloon, which they readily conceded,* at the same time placing their premises at our disposal for the purposes of the ascent. This balloon had been but recently built for them by Mr. Green, and combined in its construction all that the art and experience of the first aeronaut of the age could contribute to its perfection. In shape it somewhat resembles a pear; its upright or polar diameter exceeding

* It is but justice to the proprietors to state that no pecuniary consideration was required for the use of the balloon, which, together with the accommodation of their premises, was gratuitously tendered upon the occasion.

the transverse or equatorial by about one-sixth; a form and proportion admitted to be at the same time most consistent with elegance of appearance, and most adapted to the wants and circumstances of aerostation. The silk of which it is formed is of the very best quality, spun, wove, and dyed expressly for the purpose; the utmost breadth of the gores, which are alternately white and crimson, is about forty-four inches; down the centre of each, and worked in the original fabric, runs a band or ridge of extra thickness, calculated to give additional strength to the texture of the material, and to arrest the progress of any rent or damage which might accidentally occur. The height of this enormous vessel is upwards of sixty feet; its breadth about fifty. When fully distended it is capable of containing rather more than 85,000 cubic feet of gas; and under ordinary circumstances is competent to raise about 4000 pounds, including its own weight and that of its accessories, which alone may be reckoned at about one-fourth.

The car which appertains to this balloon is in proper keeping with its gigantic mate. It is composed of wicker-work, in the form of an oval, about nine feet in length and four in breadth. It is suspended by ten ropes to a hoop of six feet in diameter, and in thickness a like number of inches, formed of two circles of ash, one within the other, forcibly bent by steam, and retained in their position as well as strengthened by a triple tier of cable, which is enclosed between them. At either end of the car are two seats, fully capable of accommodating three persons each; while across it in the middle, and somewhat raised, is extended a bench about a foot in width, which, besides aiding to preserve the form of the vehicle against its own weight or other external pressure, serves as a frame to support a windlass intended for the purpose of raising or lowering the guide-rope whenever it may be required. In addition to these conveniences, the entire bottom of the car was on the present occasion fitted with a cushion, intended to be used as a bed in case adverse circumstances, by keeping us at sea or otherwise, should have compelled us to prolong the duration of our voyage to such an extent as to make it necessary to repose.

All the preliminary arrangements being now completed, after several unavoidable delays, occasioned chiefly by the weather, the day of departure was fixed for Monday, November 7th, 1836, and the process of inflation having been commenced at an early hour, everything was got ready for starting by one o'clock in the afternoon of the same day. As it had been resolved for special reasons that the ascent should not be made public, very few persons were present on the occasion within the precincts of the gardens. Outside, however, it was far different. Attracted by the prospect of the balloon during the process of its inflation (no pains having been taken to conceal it from public view), a large concourse of persons had been assembling since an early hour in the morning, and by the time that all was completed the multitude had already amounted to several thousands. So anxious, indeed, did they appear to witness the proceedings that serious apprehensions began to be entertained towards the conclusion, lest the fences and palisades which enclosed the gardens might finally give way beneath the unwonted pressure of the numbers with which they were literally crowded.

The appearance which the balloon exhibited previous to the ascent was, in truth, no less interesting than strange. Provisions, which had been calculated for a fortnight's consumption in case of emergency; ballast to the amount of upwards of a ton in weight, disposed in bags of different sizes, duly registered and marked, together with an unusual supply of cordage, implements, and other accessories to an aerial excursion, occupied the bottom of the car; while all around the hoop and elsewhere hung cloaks, carpet-bags, barrels of wood and copper, speaking-trumpets, barometers, telescopes, lamps, wine-jars, and spirit-flasks, with many other articles designed to serve the purposes of a voyage to regions where, once forgotten, nothing could be again supplied.

Amongst the various contrivances which the peculiar circumstances of the case had led us to adopt was a machine for warming coffee and other liquors, in which the heat developed in the process of slaking quicklime was made to supersede the necessity of actual fire. This machine was found to answer the purpose perfectly well, although the dangers which it was intended to obviate are really not such as to require the aid of similar precautions. With that degree of prudence and attention which can at all times be commanded, no absolute peril need be apprehended from the employment of fire under proper restrictions. During the whole night we had a lamp burning constantly, nor did we at any time suffer anxiety on account of its presence, or perceive any occasion even temporarily to desire its extinction.

To provide against the inconveniences which we might have experienced subsequent to our descent in continuing our journey through a foreign country, we likewise took the precaution to furnish ourselves with passports directed to all parts of the Continent, specifying the peculiar nature of our voyage, and entitling us to exemption from the usual formalities of office.

Finally, we were also charged with a letter to His Majesty the King of Holland, from Mr. May, His Majesty's

Consul-General in London, which letter was put into the post-office at Coblentz on the evening of the day succeeding our departure.*

Thus prepared, and duly accoutred, at half-past one o'clock the balloon was dismissed from the ground, and rising gently under the influence of a moderate breeze bore speedily away towards the south-east, traversing in her course the cultivated plains of Kent, and passing in succession nearly over the towns of Eltham, Bromley, Footscray, and others, whose variegated outlines beautifully diversified the rich landscape that lay beneath us. The weather was uncommonly fine for the time of year; a few light clouds alone floated in the sky, and at least as useful as ornamental, served to indicate the existence of different currents at different altitudes: an information of which, it will be seen hereafter, we were enabled to avail ourselves with much effect.

Continuing in a south-easterly direction, at forty-eight minutes past two† we crossed the Medway, at the distance of about six miles to the west of Rochester, and in little more than an hour after ‡ were in sight of the city of Canterbury, the lofty towers of its cathedral bearing distant about two miles, in an easterly direction. In honour of the mayor and inhabitants of that city, under whose patronage our celebrated pilot had twice before ascended, we lowered a small parachute containing a letter addressed to the mayor, and couched in such terms as our hurried passage would permit us to indite.§

In a few minutes after ‖ we obtained our first view of the sea, brightening under the last rays of a setting sun, and occupying the extreme verge of the horizon, in the direction in which we were now rapidly advancing.

During the latter period of this part of our voyage the balloon, perhaps owing to the condensation occasioned by the approaching shades of evening, had been gradually diminishing her altitude, and for some time past had continued so near the earth as to permit us, without much exertion, to carry on a conversation with such of the inhabitants as happened to be in our immediate vicinity. So close, indeed, were we at one time as to be able distinctly to observe a covey of partridges, which either our approach or some other equally dreaded apparition had dislodged from their resting-place, and sent to seek a refuge on the borders of a wood which lay adjacent. A whole colony of rooks, alarmed, no doubt, by our formidable appearance, rose likewise in dismay, and after rending the air for miles round with their cries and vainly trying the protection of the neighbouring woods, finally dispersed, scattering themselves in every direction over the surface of the earth beneath.

Perhaps there is no situation conceivable from which the beauties of nature are seen to greater advantage or with more singular effect than that wherein the spectator is placed, when, seated in a balloon, he happens by circumstances to be brought into closer approximation with the earth beneath. The increased distinctness of the different objects, the novel aspect under which a vertical examination presents them to the view, the isolated position occupied by the beholder, and above all the exquisite motion which, however undistinguishable from its absolute effects upon the person, exhibits to the eye the ever-varying charms of rapid flight, are all effects perceivable under no other circumstances—and even denied to the aeronaut himself when occupying a higher range and indulging in a more extensive survey. It is not, in fact, the superior elevation and vast extent of prospect that under any circumstances constitute the real charms of such exhibitions, or contribute most to their enjoyment; and if we take the trouble carefully to examine the impressions which such scenes under such circumstances are wont to inspire, we shall find that, to whatever class they may at first appear to be referable, they are not nearly so much the

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* Of the due arrival of this letter, and His Majesty's gracious reception of it, we received the following testimony in a letter from Mr. May, shortly after we reached Paris:—

SIR, London, November 28, 1836.

Perceiving from the accounts in the newspapers that you and your friends have arrived at Paris, I lose no time in having the satisfaction of thanking you very sincerely for the care taken of the letter I took the liberty of intrusting to your kindness, for the purpose of having it forwarded to the King, at the Hague: it reached its destination on the 12th of November, through the post-office at Coblentz, and His Majesty was very much gratified at receiving a letter from England by so novel a mode of conveyance as a balloon. The King has written a memorandum on the letter "*to be carefully preserved*," wishing to keep it as a remembrance of this, as yet, extraordinary occurrence. I congratulate you and your companions on the success of your enterprise, and remain with great regard, Sir,

Your most obedient, humble servant,

J. W. MAY.

† The registry of the times and distances, as also of the direction of our course by the compass, during the voyage, was the particular province of Mr. Hollond, to whose Journal the author is indebted for all information on these points, as well as for many more valuable observations, which will be found interspersed throughout the following narrative.

‡ Five minutes past four.

§ Of the due receipt of this letter, as well as of one to the same effect, which we subsequently addressed to the Mayor of Dover, we have since been informed; though the others, which we discharged by similar means at different periods of our voyage, we have reason to believe never reached the hands for which they were designed.

‖ Fifteen minutes past four.

offspring of pleasure as of surprise—of real critical delight as of that sort of gratification which is indebted to wonder and astonishment for its principal effect. To this conclusion I have been chiefly led by a consideration of the very beautiful appearance which the country presented, as under the influence of a gradual depression we slowly approached the ground, and for some time continued to skim along its surface at the slight elevation of a few hundred feet. The various objects, which, seen from on high, appeared like mimic representations of an ideal world, now gradually developed themselves, and assumed the character and aspect of reality. The forests and parks, no longer an indefinite mass of something green, opened at our approach, separating into individual trees, the leaves and branches of which seemed almost within our grasp as we hurried over them. The houses, roads, enclosures, canals, and other minuter indications of civilised society, before scarcely appreciable, now also began to display themselves in their true colours, adding the charms of particular interest to that which was otherwise but imposing from its general effect; while the most interesting features of all, the living forms of nature, till now altogether invisible, began to mingle in the scene, and gave life and expression to what was otherwise at best but an inanimate though brilliant landscape.

About this time the first opportunity occurred of showing how far it is possible for the skilful and experienced aeronaut to influence the course of his aerial vessel by availing himself of the advantages which circumstances frequently place at his disposal. Shortly after we had lost sight of the city of Canterbury a considerable deviation appeared to have taken place in the direction of our route. Instead of pursuing our former line of south by east, which was that of the upper current, by means of which we had hitherto advanced, it became apparent that we were now rapidly bearing away upon one which tended considerably to the northward, and which, had we continued to remain within the limits of its influence, would have shortly brought us to sea in the direction of the North Foreland. As it had all along been an object to proceed as near to Paris as circumstances would permit,* we resolved to recover as soon as possible the advantages which a superior current had hitherto afforded us; and accordingly rose to resume a station upon our previous level. Nothing could exceed the beauty of this manœuvre, or the success with which the balloon acknowledged the influence of her former associate. Scarcely had the superfluous burden been discharged proportioned to the effect required, when slowly she arose, and sweeping majestically round the horizon, obedient to the double impulse of her increasing elevation and the gradual change of current, brought us successively in sight of all those objects which we had shortly before left retiring behind us, and in a few minutes placed us almost vertically over the Castle of Dover, in the exact line for crossing the straits between that town and Calais, where it is confined within its narrowest limits.†

Up to the present moment nothing had appeared calculated to confer particular distinction upon our enterprise, or to awaken the impression that what we had undertaken differed in any respect from the usual class of such excursions. The case, however, was now shortly to be changed; a new and untried element was about to enter upon the scene, producing new relations and requiring the exercise of new resources. The knowledge that whenever we might feel inclined it was in our power to terminate our voyage by descent (which gives such a sense of security to all excursions over land) was about to yield to the conviction that, no matter how urgent the desire, how imperious the necessity, *that* expedient would in future be withheld from us until it had pleased Providence to convey us to new regions, and afford us once more the circumstances of a solid resting-place. When or where that might be, was a question as doubtful as the winds by which alone it could be determined; nor was it the smallest of the many charms peculiar to our situation, that it was, and must for some time remain, a matter of the most complete incertitude what portion of the globe was next destined to receive us. Confident, however, in our own resources, I may safely assert that it was to us a matter of the most perfect indifference in what manner that uncertainty should be decided: and I feel convinced that I but speak the sentiments of the whole party when I declare that not a single particle of anxiety as to our own personal safety for a moment disturbed the ardent desire we all felt to push to a creditable bearing the enterprise in which we were embarked.

It was forty-eight minutes past four when the first line of waves breaking on the beach appeared beneath us,

* The proprietors of the balloon having contemplated making an ascent from Paris, and Mr. Hollond having undertaken to transfer the balloon thither, it became a consideration with us not to increase our distance from that capital more than was consistent with the main object of the expedition.

† To the circumstances of this transaction, the apparent retardation of our course by the circuitousness of the route, the length of time we consequently remained in sight, and, above all, the rectilinear direction of our approach, is undoubtedly to be attributed the observation contained in the newspapers, that the progress of the balloon did not exceed the rate of four or five miles an hour; an assertion which a slight consideration of the time we had left London, and the distance we had accomplished, would have been sufficient to disprove. According to the above method of calculation, the mean rate of our course, up to the time referred to, was somewhat more than twenty-five miles an hour.

and we might be said to have fairly quitted the shores of our native soil, and entered upon the hitherto dreaded regions of the sea.

It would be impossible not to have been struck with the grandeur of the prospect at this particular moment of our voyage; the more especially as the approaching shades of night rendered it a matter of certainty that it would be the last in which earth would form a prominent feature that we might expect to enjoy for a considerable lapse of time. Behind us, the whole line of English coast, its white cliffs melting into obscurity, appeared sparkling with the scattered lights, which every moment augmented, and among which the lighthouse of Dover formed a conspicuous feature, and for a long time served as a beacon wherewith to calculate the direction of our course. On either side below us the interminable ocean spread its complicated tissue of waves without interruption or curtailment, except what arose from the impending darkness and the limited extent of our own perceptions. Slightly agitated by a wind unfelt by us, its pliant surface glistened faintly as it rose and fell, catching for an instant by the momentary obliquity of its parts the few rays of light that still lingered above the horizon, and losing them again as they turned their opposing outlines towards a darker quarter. On the opposite side a dense barrier of clouds rising from the ocean like a solid wall, fantastically surmounted, throughout its whole length, with a gigantic representation of parapets and turrets, batteries and bastions, and other features of mural fortification, appeared as if designed to bar our further progress, and completely obstructed all view of the shores towards which we were now rapidly drawing nigh. Upon the glittering plain which thus lay stretched before us a few straggling vessels, some of which had already begun to mount their lights, alone appeared, issuing from beneath the dark mantle of clouds that rested, as it were, upon the very bosom of the deep. In a few minutes after, we had entered within its dusky limits,* and for a while became involved in the double obscurity of the surrounding vapours and of the gradual approach of night. Not a sound now reached our ears; the beating of the waves upon the British shores had already died away in silence, and from the ordinary effects of terrestrial agitation our present position had effectually excluded us.

I scarcely know whether it is an observation worthy of being committed to paper, but the sea, unless *perhaps* under circumstances of the most extraordinary agitation, does not in itself appear to be the parent of the slightest sound. Unopposed by any material obstacle, an awful stillness seems to reign over its motions. Nor do I think that even under *any* circumstances, no matter how violent, can any considerable disturbance arise from the conflict of its own opposing members. The impossibility of ever having been placed in a situation to bring this fact under the cognizance of our senses, is no doubt the reason why it has never before been noticed. On the shore or in the sea, no one has ever been present, independent of that material support, the absence of which is necessary to the success of the experiment; it is in the balloon alone, suspended in elastic ether, that such a phenomenon could either have been verified or observed.

According as we proceeded, the lower strata of the vapoury bed in which we rested would slowly appear to dissolve, and, opening beneath us, occasionally reveal a partial glimpse of the sea, now rapidly beginning to assume the sable livery of night. Across the field of view which thus became exposed a solitary ship might now and then be seen to pass, entering on one side like the spectral representation in some magic lantern, and, having sped its course, silently disappearing on the other. Wreaths of mist shortly after intervening, the whole would be swept from our view, leaving us once more enveloped in the dark folds of the prevailing vapours.

In this situation we prepared to avail ourselves of those contrivances, the merits of which, as I have already stated, it was one of the main objects of our expedition to ascertain; and consequently, to provide against the increase of weight proceeding from the humidity of the atmosphere, naturally to be expected on the approach of night, we commenced lowering the guide-rope, with the floating ballast attached, which we had provided for the occasion.

Scarcely, however, had we completed our design, and were patiently awaiting the depression we had anticipated, ere the faint sound of the waves beating against the shore again returned upon our ears, and awakened

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* Now dark and deep the night begins to fall,
A shade immense, sunk in the quenching gloom;
Magnificent and vast are heaven and earth;
Order confounded lies, all beauty void;
Distinction lost, and gay variety
One universal blot: such the fair power
Of light to kindle and create the whole.—THOMSON.

our attention. The first impression which this event was calculated to convey was that the wind had changed, and that we were in the act of returning to the shores we had so shortly before abandoned. A glance or two, however, served to show us the fallacy of this impression; the well-known lights of Calais and of the neighbouring shores were already glittering beneath us; the barrier of clouds which I have before mentioned as starting up so abruptly in our path as abruptly terminated; and the whole adjacent coast of France, variegated with lights, and rife with all the nocturnal signs of population, burst at once upon our view. We had, in fact, crossed the sea; and in the short space of about one hour from the time we had quitted the shores of England were floating tranquilly, though rapidly, above those of our Gallic neighbour.

It was exactly fifty minutes past five when we had thoroughly completed this *trajet;* the point at which we first crossed the French shore bearing distant about two miles to the westward of the main body of the lights of Calais, our altitude at the time being somewhat about 3000 feet above the level of the ocean. As it was now perfectly dark we lowered a Bengal light, at the end of a long cord, in order to signify our presence to the inhabitants below; shortly after we had the satisfaction to hear the beating of drums, but whether on our account, or merely in performance of the usual routine of military duty, we were not at the time exactly able to determine.

Before dismissing the sea, a word or two seems required to counteract a vague and incorrect impression regarding its peculiar influence upon the buoyancy of the balloon, arising from the difficulties experienced by Messrs. Blanchard and Jeffries in their passage of the same straits in the year 1785, and the apparently unaccountable removal of these difficulties as soon as they had reached the opposite coast. So many, however, are the circumstances within the range of aeronautical experience to which, without intruding upon the marvellous or calling new affinities into existence, these effects can be satisfactorily attributed, that the actual difficulty lies in ascertaining to which of them they are most likely to have owed their origin. Of these the increase of weight by the deposition of humidity on the surface of the balloon, occasioned by the colder atmosphere through which the first part of their journey had to be pursued, and the subsequent evaporation of the same by the rise of temperature to which they necessarily became subjected as soon as they came within the calorific influence of the land, is in itself quite sufficient to explain the difference that existed in the buoyancy of the balloon during the different stages of its progress. Even in the absence of any humidity whereby the actual weight of the balloon could have been increased, the mere diminution of temperature, by condensing its gaseous contents, and their subsequent rarefaction by the altered temperature they were sure to encounter when they reached the opposite coast, is more than enough to account for even much greater effects than those to which it is here intended to apply. As far as we were concerned, certainly no such uncommon impression was observable, nor did we experience any diminution of ascensive power in our transit across the sea beyond what we should have expected under similar circumstances over a similar extent of land.

Having thus completed what may be termed the first stage in our eventful voyage, we set about making such preparations as the altered circumstances of the case rendered advisable. For this purpose the copper vessels which had been intended to be used at sea if required, but which our rapid passage over that element had left us no opportunity of exercising, were again raised and withdrawn, and a simple guide-rope of about a thousand feet in length substituted in their stead. Our lamp also was lighted, and so disposed as that in case of any appearance of danger, which, however, we neither anticipated nor experienced, it could be lowered instantly to a considerable distance from the car.* These arrangements being over, and nothing for the present appearing to demand our particular attention, we gladly availed ourselves of the opportunity to allay the cravings of an appetite which the incessant occupation of the previous day had hitherto prevented us from regarding. To this effect much preparation was not required. The bench, which we have before described as forming the central division of the car, served us most conveniently as a table, and was quickly spread with the good things which had been abundantly provided to cheer our solitary flight. Cold meats of various kinds, beef, ham, fowl, and tongues, together with bread and biscuits,

* Beyond the risk attendant upon the use of fire under ordinary circumstances, there is but one situation peculiar to aerostation in which any particular danger is to be apprehended, or any particular precautions are necessary to be adopted: I mean when the balloon, in consequence of its elevation in the atmosphere, has become so much distended as to occasion the partial liberation of its contents. In such cases, which we experienced not unfrequently during the night, all that is required is merely to lower the lamp, by means of a cord, to such a distance from the car as to place it beyond the reach of the gas issuing from the neck of the balloon. If it should be necessary to discharge gas from the valve, before this is accomplished care should be had to do so by degrees, not all at once; as the balloon, being at such moments always in the act of rising, would shortly enter into the atmosphere of gas thus created around it, which, if sufficiently impregnated, would ignite and most probably occasion the destruction of the machine.

and a due admixture of wine and other liquors,* formed the bases of a repast which might in truth have proved acceptable to much more fastidious palates than ours, especially tempered as they were by the rigorous discipline of a twelve hours' fast, and a proportionate amount of bodily exertion. Accordingly, with many a joke, touching the *high* flavour and *exalted* merits of our several viands, which, however agreeable under the circumstances, will not bear repeating here, we contrived to do ample justice to the good cheer, not forgetting, amid the festivities of the scene, to drink a cordial health to the memory of those whom we had left in uncertainty behind us. With an economy, however, which had in it somewhat peculiar, the bones and other fragments, instead of being thrown over, were carefully collected, in order to be employed for ballast whenever occasion might require. We also took the opportunity of proving the efficacy of our newly-invented machine for heating coffee, and found it answer the purpose fully as well as we had expected.

The night having now completely closed in, and no prospect of any assistance from the moon to facilitate our researches, it was only by means of the lights which, either singly or in masses, appeared spreading in every direction, that we could hope to take any account of the nature of the country we were traversing, or form any opinion of the towns or villages which were continually becoming subjected to our view.

The scene itself was one which exceeds description. The whole plane of the earth's surface for many and many a league around, as far and farther than the eye distinctly could embrace, seemed absolutely teeming with the scattered fires of a watchful population, and exhibited a starry spectacle below that almost rivalled in brilliancy the remoter lustre of the concave firmament above. Incessantly, during the earlier portion of the night, ere the vigilant inhabitants had finally retired to rest, large sources of light, signifying the presence of some more extensive community, would appear just looming above the distant horizon in the direction in which we were advancing, bearing at first no faint resemblance to the effect produced by some vast conflagration, when seen from such a distance as to preclude the minute investigation of its details. By degrees, as we drew nigh, this confused mass of illumination would appear to increase in intensity, extending itself over a larger portion of the earth, and assuming a distincter form and a more imposing appearance, until at length, having attained a position from whence we could more immediately direct our view, it would gradually resolve itself into its parts, and shooting out into streets, or spreading into squares, present us with the most perfect model of a town, diminished only in size, according to the elevation from which we happened at the time to observe it.

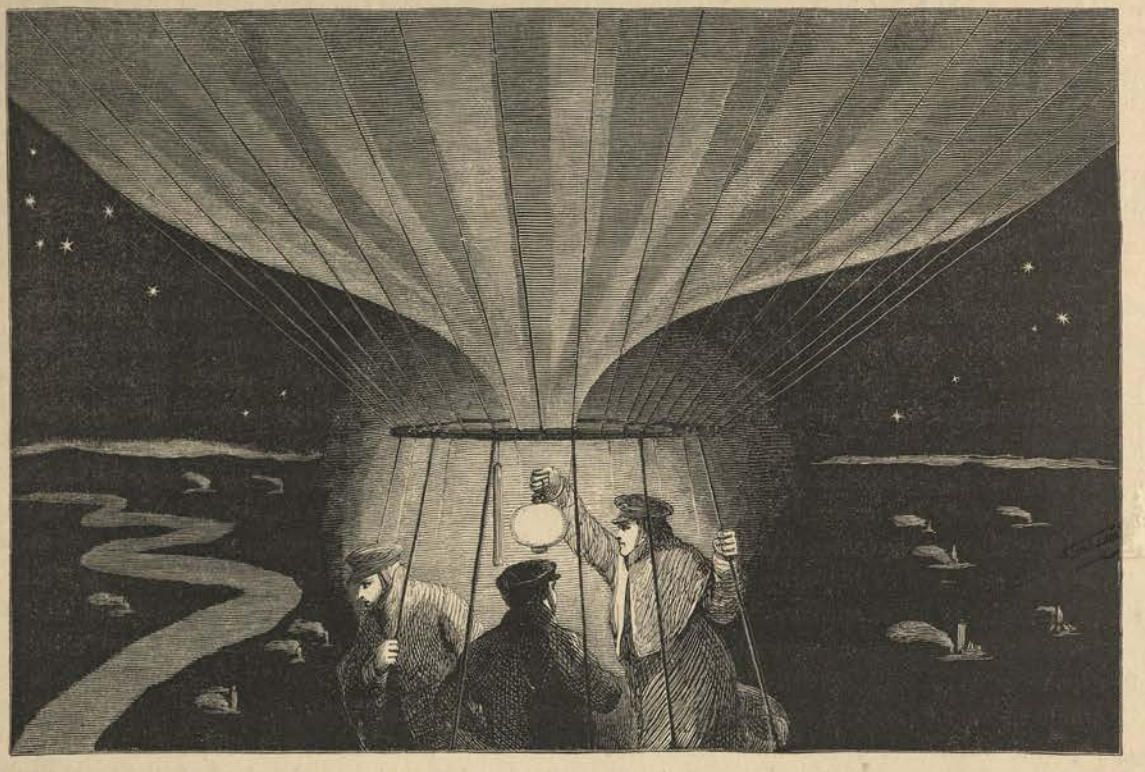
It would be very difficult, if not impossible, to convey to the minds of the uninitiated any adequate idea of the stupendous effect which such an exhibition, under all its concomitant peculiarities, was calculated to create. That we were, by such a mode of conveyance, amid the vast solitude of the skies, in the dead of night, unknown and unnoticed, secretly and silently reviewing kingdoms, exploring territories, and surveying cities, in such rapid succession as scarcely to afford time for criticism or conjecture, was in itself a consideration sufficient to give sublimity to far less interesting scenes than those which formed the subject of our present contemplations. If to this be added the uncertainty that from henceforward began to pervade the whole of our course—an uncertainty that every moment increased as we proceeded deeper into the shades of night, and became further removed from those landmarks to which we might have referred in aid of our conjectures, clothing everything with the dark mantle of mystery, and leaving us in doubt, more perplexing even than ignorance, as to where we were, whither we were proceeding, and what were the objects that so much attracted our attention—some faint idea may be formed of the peculiarity of our situation and of the impressions to which it naturally gave rise.

In this manner, and under the influence of these sentiments, did we traverse with rapid strides a large and interesting portion of the European continent, embracing within our horizon an immense succession of towns and villages, whereof those which occurred during the earlier part of the night the presence of their artificial illumination alone enabled us to distinguish.

Among these latter, one in particular, both from its own superior attractions, the length of time it continued within our view, and the uninterrupted prospect which our position directly above it enabled us to command, captivated our attention, and elicited constant expressions of admiration and surprise. Situated in the centre of a district which actually appeared to blaze with the innumerable fires wherewith it was studded in every direction to the full extent of all our visible horizon, it seemed to offer in itself, and at one glance, an epitome of all those

* For the benefit of such lovers of good cheer as may in future be tempted to prove the pleasures of aerostation, it may be as well to observe that it is not all liquors that can be conveniently employed upon such occasions. Champagne, for instance, and bottled porter, cider, soda-water, and all those which are generally termed "up in bottle," however anomalous it may appear, are by no means adapted for aerial excursions; their natural tendency to *flying* being so much accelerated by the diminished pressure which is the consequence of their elevation, that they invariably *fly off* altogether almost as soon as they have quitted the ground.

charms which we had previously been observing in detail. The perfect correctness with which every line of street was marked out by its particular line of fires; the forms and positions of the more important features of the city, the theatres and squares, the markets, and public buildings, indicated by the presence of the larger and more irregular accumulation of lights, added to the faint murmur of a busy population still actively engaged in the pursuits of pleasure or the avocations of gain, all together combined to form a picture which for singularity and



NIGHT VOYAGE TO NASSAU.

effect certainly could never have been conceived. This was the city of Liege, remarkable from the extensive ironworks which, abounding in its neighbourhood, occasioned the peculiar appearance already described, and at the time led to that conjecture concerning its identity, the truth of which a subsequent inquiry enabled us to confirm.

Almost immediately after we had passed the main body of the buildings, and before we had got quite clear of the outlets of the town, an accident deprived us of the use of our machine for heating coffee, just at the time, too, when, from the increasing rigour of the night, its services were likely to prove most particularly acceptable. Previous to our arrival in the neighbourhood of so extensive an assemblage of buildings, we had thought it advisable to suspend the action of the guide-rope, by removing to such an elevation as would dissolve its connexion with the earth, and carry it clear of the houses.* In this manner we had crossed the city, and were about to enter on the

* It will very naturally be observed that, having once submitted to interrupt the action of the guide-rope at a time when the original equilibrium of the balloon is under the influence of its greatest disturbance (as, for instance, during the course of the night), by dissolving even for a moment its connexion with the earth (which is only to be effected by a rejection of ballast equal to the weight of rope upon the ground), all the advantages which had been previously obtained by the use of it are forfeited at once, and the aeronaut placed in exactly the same circumstances as if he had proceeded so far without the aid of such an instrument at all. This observation is essentially correct; nor would we have resorted to such an expedient had the economy of our resources to their utmost been a matter of much importance to us at the time. Such, however, was not exactly the case. The sea, against which the guide-rope was especially intended to provide, had long since been passed, and no chance of its recurrence in the least probable. The chief object which we now felt in its continuance was the further trial and proof of the practicability of its employment, which, however, was not so imperative as to prevent us from suspending its action whenever occasion seemed to require it. It must not, however, be thought that these occasions resulted from any deficiency on the part of the guide-rope, or that we should have been *compelled* to discontinue the use of it at any time, had particular reasons appeared for adopting an opposite line of proceeding. Where the alternative was a matter of no moment to us, we considered it best to observe that line of conduct which we conceived to be attended with the least possible inconvenience to others, and thus in the present instance avoided coming in collision with a town which showed even at that late hour of the night such striking symptoms of activity and occupation.

suburbs, when a slight tendency to depression made it necessary to discharge a small quantity of ballast in order to maintain our elevation until we had arrived at a place where we could once more conveniently resume the use of the guide-rope. For this purpose, Mr. Green, being desirous to employ the lime which had already been used in the receiver of the machine, preparatory to its being charged afresh, and having with that intent opened it over the side of the car, unfortunately let it slip from his hand. Deprived of the most essential part of our apparatus, the lime which was intended to supply it, and of which we had a considerable store, became of no use except for the purposes of ballast, to which account we were subsequently glad to convert it. To dispose of the barrel in which it had been contained was a subject of more serious consideration, its size and weight rendering it rather a dangerous expedient to get rid of it by the ordinary method of discharge. This difficulty, however, we contrived to overcome by attaching it to a small parachute, which served in some degree to moderate its descent, in which guise it was accordingly committed to the earth, where, I have no doubt, its appearance the following morning within the private precincts of some gentleman's enclosure gave occasion to many a surmise as to the *how* or the *wherefore* of its unexpected arrival.

Having now cleared the town, and once more entered upon the fiery district in which it was embosomed, we again resumed the use of the guide-rope, which, as I have just said, on our approach to so considerable a community we had been temporarily induced to suspend. This operation brought us once more to a nearer contact with the earth, and enabled us clearly to distinguish the voices of many persons whom, notwithstanding the lateness of the hour, we conjectured to be still at work, or else congregated in the neighbourhood of some of the numerous manufactories which illuminated the subjacent country. Desirous to attract their attention, and to enjoy, in idea at least, the surprise with which so novel an apparition was well calculated to inspire them, we lighted and lowered a Bengal light nearly over their heads, at the same time addressing a few words to them through the speaking-trumpet, alternately in the French and German languages, one or other of which we thought it most probable they would understand. The effect produced upon them by such an unwonted occurrence was no doubt extreme, as we could readily perceive by the confusion which appeared to reign among them, the hurried tone and elevated expressions which immediately succeeded this unexpected declaration of our presence. *What* they thought of us, however, we had no means exactly to determine; that they were dismayed and perplexed to a considerable degree is neither to be doubted nor wondered at; for in fact, such an appearance, and at such a juncture of time, place, and circumstances, might have struck terror into bolder hearts and wiser heads than those of the honest artisans who formed our audience upon this occasion. Catching alone the rays of light that proceeded from the artificial firework that was suspended close beneath us, the balloon, the only part of the machine visible to them, presented the aspect of a huge ball of fire, slowly and steadily traversing the sky, at such a distance as to preclude the possibility of its being mistaken for any of the ordinary productions of nature, a suspicion which, even if it had existed, the terms and tone of our address must speedily have tended to efface. We did not, however, long remain to enjoy their confusion; a consideration of our own convenience more than of theirs inducing us to give them rather a sudden congé. Amongst the other sounds which issued from this Cyclopean region were some which, betokening the presence of a steam-engine at work immediately before us, suggested the propriety of raising ourselves to such a height as to place the guide-rope beyond the chance of becoming entangled in some of the machinery. To add therefore to their confusion, while lost in astonishment and drawn together by their mutual fears they stood no doubt looking up to the object of their terrors, a large shower of sand came tumbling down upon their heads, and the tail of the guide-rope at the same moment passing right in the midst of them could not fail to raise their perplexity to the highest pitch. Shortly after, the light expiring, we were lost to their view in the darkness of the sky and the increasing elevation of our ascent. This was the last spectacle of the kind which we were at present destined to enjoy. Scarcely had we passed the confines of the fiery region that had been the scene of our late exploit ere an unbroken obscurity, more profound than any we had yet experienced, involved us in its folds, and effectually excluded every terrestrial object from our view.

It was now past midnight, and the world and its inhabitants had finally committed themselves to repose. Every light was extinguished, and every sound hushed into silence; even the cheerful tones of the vigilant watch-dog, which had frequently contributed to enliven our course during the previous portion of the night, had now ceased; and darkness and tranquillity reigned paramount over the whole adjacent surface of the globe.*

* Above the mist, above the cloud,
Above the darkness and the thunder,
While storms are roaring wild and loud,
Calm shines a world of Awe and Wonder,
And there is silence o'er the thunder.—HODGSON.

From this period of our voyage until the dawning of the following day the record of our adventures becomes tinged with the obscurity of night. The face of nature completely excluded from our view, except when circumstances occasionally brought us into nearer contact with the earth, all our observations during the above period are necessarily confined to a register of incidents and sensations mingled with vague conjectures, and clouded with the mystery wherewith darkness and uncertainty were destined to involve so large a portion of the remainder of our expedition. The moon, to which we might have looked up for companionship and assistance, had she been present, was nowhere to be seen. The sky, at all times darker when viewed from an elevation than it appears to those inhabiting the lower regions of the earth, seemed almost black with the intensity of night; while, by contrast, no doubt, and the absence of intervening vapours, the stars, redoubled in their lustre, shone like sparks of the whitest silver scattered upon the jetty dome around us. Occasionally faint flashes of lightning, proceeding chiefly from the northern hemisphere, would for an instant illuminate the horizon, and after disclosing a transient prospect of the adjacent country, suddenly subside, leaving us involved in more than our original obscurity.

Nothing, in fact, could exceed the density of night which prevailed during this particular period of the voyage.* Not a single object of terrestrial nature could anywhere be distinguished; an unfathomable abyss of "darkness visible" seemed to encompass us on every side; and as we looked forward into its black obscurity in the direction in which we were proceeding, we could scarcely avoid the impression that we were cleaving our way through an interminable mass of black marble in which we were embedded, and which, solid a few inches before us, seemed to soften as we approached, in order to admit us still farther within the precincts of its cold and dusky enclosure. Even the lights which at times we lowered from the car, instead of dispelling only tended to augment the intensity of the surrounding darkness, and as they descended deeper into its frozen bosom, appeared absolutely to melt their way onward by means of the heat which they generated in their course.

Independent of the real obscurity of the night, a combination of two circumstances, peculiar to our situation, contributed to occasion the extraordinary impression of darkness which we have here feebly attempted to describe: in the first place, the total absence of all material objects capable of reflecting the scattered rays of light which might happen to exist in the surrounding atmosphere; and secondly (a natural consequence of the former), the power of availing ourselves of our own light, without dispelling or diminishing the darkness it was otherwise calculated to display. To the former of these were we indebted for the *positive* obscurity of the locality in which we found ourselves; to the second we owe the means of appreciating it by the contrast it enabled us to establish. It is evident that these two circumstances can never be made to exist in combination, except in a situation and under advantages exactly similar to ours. However it might be possible, by the most perfect exclusion of light, to effect an *artificial* obscurity capable of rivalling that to which we were *naturally* exposed, any attempt to avail oneself of the aid of light to establish the contrast upon which the real strength of the impression depends, must at once subvert the position and nullify the effect it was purposely designed to enhance.

It was now that the advantages of the guide-rope began to make themselves particularly appreciable, in the indications it afforded of the changes that were continually occurring in the level of the subjacent soil, giving us infallible warning of our approach to ground, the superior elevation of which might otherwise have occasioned us considerable inconvenience. To such an extent did these alterations at times proceed, that frequently a difference in the altitude of the barometric column would manifest a change of several thousand feet in the level of the balloon's course, while the guide-rope continuing to trail upon the ground, would indicate an uniform distance from its surface of somewhat less than its own extreme dimensions. Several times, under the influence of these changes, did we arrive † so near the earth as to be enabled to distinguish, imperfectly, it is true, some of its most prominent features; and, as the intensity of the darkness yielded to our approach, obtain some faint idea of the

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* One sun by day, by night ten thousand shine
And light us deep into the Deity!
How boundless in magnificence and might!
Oh, what a confluence of ethereal fires
From urns unnumber'd, down the steep of heaven
Streams to a point, and centres in my sight!—YOUNG.

† To prevent misconstruction, the reader is requested to observe that the expression here used does not of necessity imply that any change had taken place in the level of the balloon's course to occasion its casual interference with the earth—the changes whereby such a result became possible being entirely attributable to the latter. And yet the phrase is perfectly correct, inasmuch as the *action* by which it was effected was inherent in the former, which in the course of its onward progress became sensible of these changes, and did, strictly speaking, *arrive* in contiguity with the surface of the earth, though without any alteration in the level at which it was proceeding. I have been induced to enter into this explanation from observing that a misconstruction of the kind alluded to has already been put upon the above phrase by the commentator upon the first edition of this little narrative in one of the daily journals, and an inference drawn therefrom prejudicial to the efficacy of the guide-rope by which these supposed depressions, it is alleged, should have been counteracted.

nature of the country which lay beneath us. At these times we appeared to be traversing large tracts of country partially covered with snow, diversified with forests, and intersected occasionally with rivers, of which the Meuse in the earlier part of the night, and the Rhine towards the conclusion, constituted, as we afterwards learned, the principal objects both of our admiration and of our conjectures. Nothing could be more interesting than the glimpses which these mysterious approximations would occasionally permit us to enjoy. Slowly descending, as it seemed to us, from a region where darkness formed the only subject of our contemplations, at first some faint hallucination (but whether of earth or air we could but doubtfully determine), would appear invading the obscurity of the sable vault immediately beneath us, and giving us the first notification of our approach to something that owned a form and acknowledged the laws of the material world. Gradually, as we drew nigh, these mysterious appearances would insensibly extend themselves in space, strengthening in their outlines, and becoming more definite in their form, with an effect which, to render it more intelligible, we can only compare to that produced while looking through a telescope during the process of its adjustment, the confused and shadowy features of some distant prospect are made to pass slowly through every gradation of distinctness ere the proper focus be at length obtained. Along this indefinite plain, maintained in our level by the agency of our faithful regulator, the guide-rope, we would continue to glide for a considerable time, until some equally unexpected depression in the surface of the earth would gradually abstract it from our view, and slowly reversing all the impressions we had before experienced in our approach, once more consign us to the opaque obscurity that reigned throughout the upper regions of the air.

An instance of the extraordinary conclusions to which the vague and indistinct nature of these representations would occasionally lead us will serve to give some idea of the doubt and uncertainty that, even at the best, prevailed over all our observations and conjectures during this most interesting portion of our voyage. For some time back our attention had been particularly directed to an appearance which, in the absence of any grounds for suspecting the contrary, we very naturally concluded to proceed from some object or other on the surface of the earth below. Seen through the thick gloom of the night, and extended alone in the black space that wrapped every other object from our view, it bore the aspect of a long narrow avenue of feeble light, starting off in a straight line towards the horizon, from some point or source at some distance underneath us. What it could be, we fruitlessly endeavoured to determine. For a river, its extreme length and regularity united forbid us to assume it; while the dimensions it must have had to enable it to present so important an appearance at the elevation we then occupied, equally precluded the possibility of its being either a canal or a road, the only other objects to which we could with any degree of probability refer it. In vain we looked forward out of the car into the deep intensity of the surrounding night, concentrating all our powers of vision to the one spot, that we might catch some clearer view to determine our conjectures; in vain we racked our imagination, in the absence of the requisite visual testimony, to devise what it could be, that, amid such unbroken obscurity, contrived to make itself alone distinguishable. The more we looked, the more we doubted; the more we reflected, the more uncertain appeared the result of our speculations; nor was it till after a considerable lapse of time, induced by observing its long-continued presence in the same position, that we became finally aware that it was only one of the stay-ropes* attached to the summit of the balloon, which, hanging down along the outside at a distance of five-and-twenty feet from the car, and being, in fact, the only material object within our ken, had partially caught the rays of light from our lamp, and returned them to us under the aspect and impression we have above endeavoured to describe.†

In the midst of this intense obscurity an incident occurred which, for the effect it is calculated to produce upon the minds of those who experience it for the first time, and in ignorance of its cause, merits particularly to be noticed.

It was about half-past three in the morning, when the balloon, having gained a sudden accession of power,

* Two long cords of moderate dimensions, externally attached to the frame of the upper valve, and used to steady the position of the balloon during the inflation; as well as after the descent, during the process of emptying the gas, to prevent her from rolling on the ground. These ropes, when the balloon is full, will extend to some feet below the car, and at a distance of half the diameter of the sphere on either side of the machine.

† If any one will endeavour to imagine himself looking partly forward and partly downward from the summit of a lofty tower, when the obscurity of night is at its highest, and beholding a line partially illuminated (of the real dimensions of which he is ignorant), vertically suspended at a distance of some yards before him, he will be able to form a pretty correct estimate of the circumstances under which the above erroneous conviction was produced. He will then perceive the impossibility of determining, by the mere aid of the senses, the question of the real distance and position of the object, and will be enabled to appreciate the error by means of which the judgment was induced to refer the appearance afforded by a vertical rope a few feet off, *the presence of which it did not anticipate*, to that of some object on the horizontal plane of the earth *which it was constantly expecting to encounter*.

owing to a discharge of ballast, which had taken place a few minutes before, while navigating too near the earth to be considered perfectly safe in a country with the main features of which we were totally unacquainted, began to rise with considerable rapidity, and ere we had taken the customary means to check her ascent, had already attained an elevation of upwards of twelve thousand feet. At this moment, while all around is impenetrable darkness and stillness most profound, an unusual explosion issues from the machine above, followed instantaneously, by a violent rustling of the silk, and all the signs which may be supposed to accompany the bursting of the balloon, in a region where nothing but itself exists to give occasion to such awful and unnatural disturbance. In the same instant, the car, as if suddenly detached from its hold, becomes subjected to a violent concussion, and appears at once to be in the act of sinking, with all its contents, into the dark abyss below. A second and a third explosion follow in quick succession, accompanied by a recurrence of the same astounding effects, leaving not a doubt upon the mind of the unconscious voyager of the fate which nothing now appears capable of averting. In a moment after all is tranquil and secure; the balloon has recovered her usual form and stillness, and nothing appears to designate the unnatural agitation to which she has been so lately and unaccountably subjected.

The occurrence of this phenomenon, however strange it may appear, is, nevertheless, susceptible of the simplest solution, and consists in the tendency to expansion from removal of pressure which the balloon experiences, in rising from a low to a higher position in the atmosphere, and the resistance to this expansion occasioned by the tenacious adhesion of the silk in the folds which the comparatively collapsed state of the balloon had previously allowed it to assume. When the ascent and consequent expansion take place slowly, sufficient time is given to the included gas *gradually* to overcome this resistance, and the balloon is enabled to accommodate itself to the growing dilatation of its contents during the progress of its elevation. When, however, on the other hand, as in the case especially before us, the rapidity of the ascent is such as to anticipate the *gradual* adaptation of the balloon to the expansive tendency of its contents, the entire extrication of the folds of the silk will not take place until the internal pressure of the included gas has reached a considerable amount; when *suddenly* that extrication is accomplished, attended by those effects which we have already attempted to describe. The impression of the descent of the car in the above description is evidently a false one—on the contrary, elevated by the *longitudinal* curtailment of the balloon in the sudden recovery of its pristine form and *breadth*, the car, so far from sinking, actually springs up; it is the unexpectedness of such a movement, and its apparent inconsistency with the laws of gravitation, that occasions the delusion, the reality of which the collateral circumstances essentially tend to confirm,*

The cold, particularly during this part of the night, was undoubtedly intense, as could be perceived not less from the indications of the thermometer (ranging variously from within a few degrees below to the point of congelation) than from the effects which it produced upon the different liquors wherewith we were provided. The water, coffee, and, of course, the oil in our several vessels were completely frozen; and it was only by the actual application of the heat of the lamp that we were enabled to procure a sufficiency of the latter to supply our wants during the long term of darkness to which we were about to be subjected.

Of the advantages which in these circumstances we had expected to reap from the use of our machine for heating liquors, we had, as I have before observed, been for some time deprived by the loss of a most material part of the apparatus. In this dilemma we had tried several shifts for supplying the deficiency, but unfortunately without effect. Abandoning, therefore, the attempt, we at first became reduced to the disagreeable alternative of drinking our coffee in a state almost approaching to congelation, and finally, as it became more thoroughly frozen, found ourselves compelled to relinquish the use of it altogether.

Strange, however, as it may appear, while all around bore such unequivocal testimony to the severity of the cold, the effects produced upon our persons, undefended as they were by any extraordinary precautions, were by no means commensurate to the cause, nor such as even under ordinary circumstances we might fairly have expected to encounter.

The reason to which may be attributed this unusual exemption from the consequences of a low temperature,

* In the former editions of this narrative I had attributed the detention of the silk in its corrugated (?) form entirely to the agency of the frost upon the network of the balloon, previously saturated with moisture during its protracted sojourn at a lower elevation. Having, however, since learned from Mr. Green that he has frequently experienced the like effects from a rapid ascent without the intervention of such a cause, I am glad to have the opportunity of generalising the explanation I had given of the above phenomenon, and of assigning to the frost, in the case alluded to, its proper place as merely contributing to enhance the effect by the additional resistance it offered to the gradual dilatation of the balloon.

jusqu'alors sans égal
Le Monarque des Airs y suivit son Rival.

Gravé par S. C. Miger Graveur du Roi.

Paris chez Miger, la grande Maison neuve
Place de l'Estrapade.

Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Heldsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director.

is the absence of all current of air,—the natural result of our situation and one of the peculiar characteristics of aerial navigation.

That such a circumstance is fully adequate to the result ascribed to it, ample testimony is afforded in the accounts recently given to the public of the transactions of the great polar navigators, Captains Parry, Back, and others, in pursuit of the discovery of the north-western passage, wherein many instances are related of persons under similar circumstances not only bearing, but even enjoying, a reduction of temperature many degrees inferior to that in which we were placed. Indeed, from what we are there given to understand, the degree to which the human frame is capable of being refrigerated without experiencing pain or inconvenience appears to be almost entirely regulated by the concomitant amount of atmospheric motion. In the absence of that motion, there seems to be no limit *in nature* to the extent to which this reduction may be carried: the personages in the above expeditions frequently finding themselves exposed to a temperature 30° below zero (or 62° below the freezing-point of Fahrenheit· without even being conscious of anything extraordinary in their situation until some change in the state of the surrounding atmosphere occurred to call it to their senses.

As the night drew on to a close the appearance of the firmament became subjected to a gradual change. The stars, insensibly assuming a more natural lustre, began by slow degrees to "pale their ineffectual fires," while their light, which, bound as it were by the prevailing obscurity, had hitherto appeared concentrated and confined, each to its own particular disc, gradually became more diffuse, and, illuminating the celestial hemisphere, tended continually to diminish that intense brilliancy which, as we before observed, had characterised the aspect of the sky during the crisis of the preceding night. Among these, the morning star for a long time shone conspicuous, occupying the very centre of our eastern horizon, and creating around a halo so unwonted as almost to persuade us into the belief of a premature approach of day. Large masses of fleecy clouds now began to be imperfectly distinguished, pervading the lower regions of the atmosphere, and for a while leaving us in doubt whether they were not a continuation of those snowy districts which we so frequently had occasion to remark.

From out of this mass of vapours more than once during the night our ears had been assailed with sounds bearing so strong a resemblance to the rushing of waters in enormous volumes, or the beating of the waves upon some extensive line of coast, that it required all our powers of reasoning, aided by the certain knowledge we had of the direction we were pursuing, to remove the conviction that we were approaching the precincts of the sea, and, transported by the winds, were either thrown back upon the shores of the German Ocean, or about to enter upon the remoter limits of the Baltic.

It would be endless to enumerate all the conjectures to which this phenomenon gave rise, or the various manners by which we endeavoured to explain its occurrence. Among them those which seemed to obtain the greatest credit were that the sounds proceeded from some vast forest agitated by the winds; some rapid river rushing impetuously over a broken and precipitous channel; or finally, that the misty vapours themselves, by the mutual action of their watery particles, or their precipitated deposition upon the irregular surface of the earth beneath, had occasioned the murmurs, which, multiplied throughout so large a space, came to our ears in the formidable accents to which we have above alluded.

According as the day drew nigh these appearances vanished, with much of the doubts to which they had given rise. Instead of the unbroken outline of the sea, an irregular surface of cultivated country began feebly to display itself, in the midst of which the majestic river we had noticed for some time back appeared dividing the prospect, and losing itself in opposite directions amid the vapours that still clung to the summits of the hills, or settled in the valleys that lay between them. Across this river we now directed our course, and shortly after lost sight of it entirely behind the gently-swelling eminences by which it was bordered on both sides.

The dawn, which for some time back had been continually augmenting, had now become fully established in the upper regions of the atmosphere, although its influence as yet was but slightly exerted upon the humbler districts of the subjacent earth. All the celestial bodies had now entirely disappeared; even the morning star, which so long the subject of our admiration had continued with waning energy to contest the empire of the sky, had now retired, and we began earnestly to look forward to the arrival of the great luminary that was soon to supply their place.

About ten minutes past five one of those casual aberrations occurred, to which we have already alluded, when the balloon rising rapidly we became suddenly transported to an elevation of about 12,000 feet. This was the highest point we attained throughout the whole voyage, and the effect was, in truth, equally pre-eminent with the occasion by which it was produced. If we only reflect that our position at this altitude was such as to have

enabled us to behold objects at a distance of above one hundred and fifty miles on every side of us, had those objects been sufficiently great or sufficiently striking to fix the attention, some faint idea may be had of the immensity of prospect which at that moment became subjected to our view. We shall then be seen occupying the centre of a circle, whose diameter, extending to above three hundred miles in length, afforded us an horizon, the circumference of which exceeding an equal number of leagues, comprised within its circuit an expanse of visible surface little short of seventy-one thousand square miles. In the enjoyment of this stupendous landscape we continued for above an hour, occasionally descending a few hundred feet, and again rising to resume our station upon our former level.

In one of these latter movements, which took place at about a quarter past six,* the balloon having nearly recovered its highest elevation suddenly brought us in full view of the sun, and for the first time gladdened with the assurance of a speedy return of day.

Powerful, indeed, must be the pen which could hope to do justice to a scene like that which here presented itself to our view. The enormous extent of the prospect; the boundless variety it embraced; the unequalled grandeur of the objects it displayed; the singular novelty of the manner under which they were beheld; and the striking contrast they afforded to that situation and those scenes to which we had so long and so lately been confined, are effects and circumstances which no description is capable of representing in the light in which they ought to be placed in order to be duly appreciated.† Better far to leave it to a fertile imagination to fill in the faint outlines of a rough and unfinished sketch, than by a lame and imperfect colouring run the risk of marring a prospect which, for grandeur and magnificence, has certainly no parallel in all the vast and inexhaustible treasures of nature.

This splendid spectacle, however, we were not long destined to enjoy; a rapid descent, which shortly after ensued, for a while concealing it from our view, and once more consigning us to the shades of night, which still continued to reign unbroken throughout the lower region of the air.

Again we rose within the reach of this delightful prospect, and again did we lose sight of it amid the vapours and obscurity that accompanied our descent; nor was it till we had three times made the sun rise, and twice beheld it set, that we could fairly consider it established above the horizon and daylight complete upon the plane of the earth beneath us.

From this time forward all our observation was principally directed to the nature of the country and its adaptation to the descent which we had now resolved to effect the first fitting opportunity. To this step the uncertainty in which we necessarily were with respect to the exact position we occupied, owing to our ignorance of the *distance* we had come, especially determined us. For a long time past the appearance of the country, so unlike any with which we were acquainted, had led us to entertain serious doubts as to whether we had not already passed the limits of that part of Europe where we might expect to find the accommodation and conveniences which our own comfort and the safety of the balloon imperatively demanded. This opinion the large tracts of snow over which we had passed during the latter part of the night, bearing a strong resemblance to all we had hitherto pictured to ourselves of the boundless plains of Poland, or the barren and inhospitable steppes of Russia, considerably tended to confirm;‡ and as the region we were immediately approaching seemed to offer advantages which, under these circumstances, we could not always hope to command, we resolved not to lose the occasion it so opportunely appeared to have afforded us.

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* The time referred to here and elsewhere throughout this narrative is that of Greenwich. Upon the completion of the voyage, a variation amounting to about thirty-four minutes was found to exist between the times indicated at its two extremes; the chronometers of Weilburg being so much in advance of those of London. This variation was occasioned by the easterly direction of our course, and the difference of longitude.

† Yonder comes the powerful king of day,
Rejoicing in the East. The lessening cloud,
The kindling azure, and the mountain's brow,
Illumined with fluid gold, his near approach
Betoken glad. Lo! now, apparent all,
Aslant the dew-bright earth and colour'd air,
He looks in boundless majesty abroad,
And sheds the shining day, that burnish'd plays
On rocks, and hills, and towers, and wandering streams,
High gleaming from afar. Prime cheerer, light!
Of all material beings first and best!
Efflux divine! Nature's resplendent robe!
Without whose vesting beauty all were wrapt
In unessential gloom; and thou, O sun!
Soul of surrounding worlds! in whom best seen
Shines out thy Maker.—THOMSON.

‡ This presumption will not appear so extravagant when we consider the enormous rapidity with which the course of the balloon is liable to be affected, and the impossibility of obtaining any indication as to its amount during the long period of darkness which we had just encountered. Had we continued to pursue the greatest rate of motion at which the balloon has been known to be impelled in these latitudes, we should, ere the period of our descent, have accomplished a distance of above two thousand miles.

As soon as we had come to this determination all preparations were speedily commenced for the descent; the guide-rope was hauled in (an operation of much labour, owing to the bad construction and imperfect action of the windlass), the grapnel and cable lowered, and everything got ready that we might be able to avail ourselves of the first and fittest opportunity that might occur. To this intent, likewise, we quitted our exalted station, and sought a more humble and appropriate level, along which we continued to range for some time and to a considerable distance; the yet early hour of the day deterring us from completing the descent, in the fear of not obtaining that ready assistance from the inhabitants which it is always the main object of the aeronaut, if possible, to secure.

As the mists of the night began to clear away from the surface of the soil we were delighted to perceive a country intersected with roads, dotted with villages, and enlivened with all the signs of an abundant and industrious population. The snowy covering which so lately chilled us with its forbidding aspect had now disappeared, except a few patches which still lingered in the crevices, or lay spread within the sheltered recesses of the numerous hills by which the surrounding neighbourhood was particularly distinguished. On the summit of one of these an isolated edifice of considerable magnitude and venerable antiquity appeared, just breaking through the vapours that yet partially concealed the morning landscape. Seated upon the very point of the eminence, it seemed like some ancient baronial castle, overlooking the prospect and extending its protection to a cluster of humbler dwellings that straggled around its base. One or two towns, likewise, of superior pretensions were distinctly to be seen; giving promise of accommodation and advantages which, in our present emergencies and under our present convictions, were not to be neglected. Accordingly, having pitched upon the spot most proper for the purpose, the valve was opened and we commenced our descent.

The place so selected was a small grassy vale, of about a quarter of a mile in breadth, embosomed in hills, whose sides and summits were completely enveloped with trees. Beyond this, on the opposite side, lay another valley of the same description; the only one visible for many miles, where we could conveniently effect our landing; an endless succession of forest scenery completing the landscape in the direction in which we should have had to proceed. Into the former of these we now precipitated our descent, with the design of alighting, if possible, in the centre, clear of the woods that enclosed it on all sides. In these hopes we were, however, disappointed: the wind suddenly increasing as we approached the ground, so much accelerated the onward course of the balloon, that before the grapnel could take effectual hold of the soil we had passed the middle of the valley, and, sweeping rapidly over the ground, were borne close against the wooded declivity that flanked its eastern termination. To discharge a sufficiency of ballast to raise the balloon, and carry her clear of the impending danger, was the natural remedy. An unexpected obstacle to this operation here again presented itself; the sand which forms the ballast, frozen during the night into a solid block of stone, refused to quit the bag in the proportion required, and no time remained to search for one more suited to the occasion. Not a moment was, in fact, to be lost; the valley was passed, and the branches of the trees that clothed the opposing precipice were already within a few feet of the balloon; the grapnel continued to drag, and no chance appeared of arresting her progress onward. In this emergency one alternative alone remained, and the sack itself, with all its contents, to the amount of fifty-six pounds in weight, were at once consigned to the earth. In a moment the balloon, lightened of so large a portion of her burden, had sprung up above a thousand feet, and clearing the mountain at a bound, was soon in rapid progress to the realms above. To counteract the consequence of this sudden accession of power, and avoid being carried beyond the reach of the second valley, which we have already described as the only other available spot for our descent, the valve was again opened, and issue given to a large quantity of gas; sufficient, as was calculated, to check the course of the balloon in time to enable us to attain the point to which all our views were now directed.

A second time, however, we were doomed to be disappointed. No sooner had we completed this manœuvre, than by another caprice of nature, the wind suddenly abating, we found ourselves at once becalmed and rapidly descending into the bosom of the woods that capped the summit and clothed the sides of the intervening eminences. From this dilemma we were only relieved by the timely discharge of a further portion of our weight; not, however, before the accelerated descent of the balloon had brought us within a cable's length of the ground,* and almost in contact with the upper surface of the wood. Here, for a few moments, we continued to hover; the grapnel struggling with the topmost branches of the trees, and grasping and relinquishing its hold according to the varying impulse of the slight wind that prevailed at our elevation.

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* The length of the cable to which the grapnel is attached is about one hundred and twenty feet.

While in this situation, we perceived, standing in a path in the wood, two females, the first inhabitants we had noticed, lost in astonishment and seemingly petrified with gazing upon so astounding an apparition. It was in vain we addressed them with a speaking-trumpet, in the hopes of procuring the assistance of some of the male population, which we conjectured could not be far off; the sound of our voices, proceeding from such an altitude, and invested with such an unearthly character, only augmented their astonishment, and added to their fears; they fled incontinently, and without waiting further parley sought the shelter of the neighbouring coverts.

After continuing for a few minutes longer in these straits, we at length reached the confines of the wood; when, resolving not to be again baffled in our designs by the treacherous inconstancy of the wind, the valve was opened to its fullest dimensions, and the grapnel taking hold shortly after, we came to the ground with considerable though by no means disagreeable rapidity.*

Too much praise cannot be given to Mr. Green, for his excellent conduct throughout the whole of this intricate pilotage. It is not by reading a mere description of the difficulties encountered, and the manner by which they were counteracted, that a correct judgment can be formed upon the merits of such a case as this; a further consideration is necessary—the knowledge that these difficulties did not proceed from the same source as the remedies by which they were defeated. In this light it is that the conduct of our celebrated captain has a right to be criticised; the impediments were those of uncontrollable nature—the victory, and the means employed to secure it, were all his own.

As soon as the descent was completed, and the power of the balloon sufficiently crippled to permit one of the party to quit the car, the inhabitants, who had hitherto stood aloof, regarding our manœuvres from behind the trees, began to flock in from all quarters; eyeing, at first, our movements with considerable suspicion, and not seldom looking up in the direction from which we had just alighted, in the expectation, no doubt, of witnessing a repetition of this, to them, inexplicable phenomenon.

A few words in German, however, served to dissipate their fears, and secure their services. The first question, "Where are we?" was speedily answered, "In the Duchy of Nassau, about two leagues from the town of Weilburg." The second was theirs, "Where do you come from?" "From London, which we left yesterday evening." Their astonishment at this declaration may be easily conceived. The fact, however, was not to be disputed. What they had seen was to the full as marvellous as anything we might choose to relate, and certainly enough to entitle us to consideration and command respect.

At all events, whether from *above* or *below*, we were evidently strangers; a circumstance of itself sufficient at all times to have engaged the sympathy and assistance of an artless and hospitable people, but which, coupled as it was, in our case, with the possibility of one or other of the two preceding alternatives, brought us in for no small amount of homely deference and attention.

To these kindly feelings we endeavoured to contribute by every means in our power. Our stock of biscuits, wine, and brandy quickly disappeared, with a relish which the novelty of the journey they had so lately performed, tended, no doubt, considerably to augment. The brandy, in particular, so much stronger than any they had ever before essayed, attracted their special admiration; and as they, each in succession, drank off their allowance, they seemed by the exclamation of "Himmlischer Schnapps" (celestial dram), which accompanied every draught, as well as by the upward directions of their eyes, to denote the quarter from which they now became fully convinced a beverage so delicious could alone have proceeded.

With all the willingness, however, which they displayed in their endeavours to assist us, it required no little management, and a thorough knowledge of the peculiar habits and propensities of the *animal*, to turn their services to a proper account. In the first place, the operation of emptying the balloon, at all times sufficiently tedious, was rendered more so in the present instance from the quantity of frozen moisture it had imbibed in the course of the night, and which we were desirous to get rid of by a little exposure to the sun before we had completely enclosed it. Now Germans, proverbially indolent, require no small degree of excitement to keep their attention and their services engaged to any continued pursuit. The slightest relaxation, therefore, on our part, was sure to be attended with a corresponding relaxation upon theirs, and in the event of our taxing their patience too severely there was no small probability that they would slacken in their efforts, and getting tired of seeing nothing done, eventually abandon us to our resources. On the other hand, to occupy their attention by a liberal distribution of "Schnapps"

* It was half-past seven o'clock when this occurrence took place, and our descent could be fairly said to be completed. The duration of our voyage may therefore be calculated at exactly eighteen hours.

(the only alternative that remained to us), was not without its particular inconvenience. Germans are never without pipes in their pockets, and never think of eating or drinking without concluding the operation by abstracting the said pipes and indulging in a friendly fumigation; in which case, besides incurring the risk of combustion from so many fireworks in exercise at once, we should have had to calculate upon the certain loss of one hand to each individual, and the other deprived of half its energy, when two, well applied, were scarcely enough for the purpose. Into this error we had fallen at first; the consequence was that half of our efficient forces were already laid up smoking, and it was only by a timely withdrawal of the supplies that we were enabled to command the services of the remainder.

With all these drawbacks, it was nearly twelve o'clock before the whole of our operations were concluded and the balloon, with all its accompanying apparatus, safely adjusted in the bottom of the car. Our next step was to procure a cart and horses to convey it to Weilburg, the nearest place where we could expect to meet with the accommodation which the circumstances of the case rendered desirable. For this, as there was but one in the neighbourhood for many miles around suitable to the purpose, we were compelled to submit to a further delay of about an hour and a half. In the mean time we had some difficulty in inducing our kind and able coadjutors to accept of any remuneration for the timely assistance they had afforded us; nor was it until we had evinced by our perseverance a determination not to be refused, that we finally succeeded in persuading them to come to some definite arrangement among themselves as to what amount of compensation should be bestowed, and in what manner it should be distributed. Accordingly, as the magnitude of their numbers precluded the possibility of extending our bounty to all, fourteen were selected out of those who had taken a most prominent part on the occasion, and the sum of half a franc each, equal to about fivepence English, stated as the full amount of their expectations. This sum, with more liberality than prudence, as appeared in the sequel, was immediately doubled, when a scene occurred to which no description is capable of communicating the entire effect. Scarcely had this unexpected extension of our bounty been announced to the fourteen fortunate individuals who were to participate in it, ere as many unwashed beards, black and brown, white, yellow, red, and grey, were simultaneously and unceremoniously thrust forward for the purpose of signifying their gratitude by effecting a salute, in a style which, in our country at least, is usually considered one of the peculiar privileges of the gentler sex. To refuse the proffered courtesy might have been construed into an affront, and we were absolutely in the very act of being subjected to this agreeable ordeal, when the seasonable arrival of the long-expected vehicle saved us from the full infliction of the direful penalty. Overjoyed at our timely deliverance, all hands were summoned to assist in loading the waggon, and having mounted thereon ourselves, we quitted this, to us, ever memorable spot,* and attended by an amazing concourse of persons of every rank, age, and sex, set out for Weilburg, which a few hours enabled us to attain.

The fame of our adventure had, however, already preceded us. On our approach we found ourselves greeted with acclamations, and a ready welcome and honourable attentions awaited our arrival. All the resources of the town were immediately placed at our disposal; the use of the archducal manège was tendered for the occupation of the balloon; and sentries, more indeed as a guard of honour than of protection, stationed at the doors and avenues leading to the place of its reception.

Here then we resolved to remain until our future movements should be determined by the return of the letters we had despatched to Paris immediately upon our descent. In the mean time, favoured by the peculiar advantages of the building, we availed ourselves of this delay to open and inflate the balloon, as well for the purpose of drying and examining it, as to make some return for the obligations we were under, by contributing to gratify the curiosity of our hospitable entertainers. It would be scarcely credible were I to relate the interest wherewith the inhabitants seemed to regard this, to them, novel exhibition; the numbers that poured in to witness it from all quarters, for many a league around, or the grateful acknowledgments with which they never ceased to overwhelm us during the fortnight it continued open to public inspection.

Nothing in fact could surpass the courtesy and attention that we experienced from this simple-hearted and hospitable community, during the whole period of our residence at Weilburg. Every one seemed to vie with each other in conferring favour and contributing to our entertainment. Balls, dinners, concerts, and other amusements

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* The exact spot where the event took place was in a field adjacent to a mill, known by the name of Dillhausen, situated in the valley of Elbern, in the commune of Niedershausen, about two leagues from the town of Weilburg; already, by a curious coincidence, noted in the annals of aerostation as the place where the celebrated M. Blanchard effected his landing, after an ascent which he made at Francfort in the year 1785.

were given without intermission; poems were composed in honour of our adventure, and the congratulations of the city presented to us by a deputation of the principal citizens, headed by their chief civil officer, in the form of a document duly signed and sealed by the competent authorities.

Among the festive recreations to which our unexpected arrival at Weilburg gave rise, we must not omit to mention the ceremony of christening the balloon, which took place the day previous to our departure, the Baron de Bibra, Grand Maître des Eaux et Forêts, and the Colonel Baron de Preen, being the godfathers; the Baroness de Bibra and the Baroness de Dungern, the godmothers, on the occasion. The balloon having been distended with air to the greatest size the dimensions of the place would admit, eight young ladies, in company with Mr. Green, entered within the gigantic sphere, and the name of "The Great Balloon of Nassau" having been bestowed by one of their number, Mdlle. Theresa, the lovely and amiable daughter of the Baron de Bibra, accompanied by a copious libation of wine, the ceremony was concluded with a collation, consisting of the remains of our stock of provisions, which had been unconsumed at the time of our descent.

One other act of honourable attention yet remains to be recorded. On the evening of the same day, the last we had to enjoy in the society of this courteous and hospitable population, it was resolved to signalise the occasion of our visit, and the agreeable intercourse to which it had given rise, by some more flattering display of favour than any we had yet experienced. A grand festival was consequently held in the principal chambers of the chief inn, which had been tastefully decorated for the purpose, and at which all the first personages of the town were assembled to meet us. After the dinner, or rather the supper had been concluded, and the mutual goodwill of the parties established by a general interchange of glasses, occasion was taken to pronounce a short discourse in Latin verse,* composed by M. Friedemann, Principal of the Academic Gymnasium, in which a comparison is instituted between our late enterprise and others of a similar nature; at the conclusion of which a crown of laurels was placed upon the head of Mr. Green, and his health with that of his companions proposed and drunk amid general and repeated acclamations.

From such an universal display of hospitality and kindness it would be difficult to single out any to whom in particular our thanks are due; among those, however, whose station and circumstances entitle them to especial notice, were the Baron de Bibra, Grand Maître des Eaux et Forêts; the Baron de Dungern, Grand Ecuyer de son Altesse, pensionné; the Colonel Baron de Preen, and their respective ladies; M. Hutschsteiner, Premier Conseiller de Médecin; M. Giesse, Premier Conseiller de Justice; M. Friedemann, Superior of the University, and M. Barbieux, likewise attached to the same establishment; together with a variety of others, the mere repetition of whose names would prove but a little recompense for the kindness we received at their hands.

Through the Baron de Bibra, likewise, we took the opportunity to present to His Highness the Duke of Nassau the flags† which accompanied the expedition, as a slight token of the hospitable reception we had experienced in his territories, with a request that they should be preserved, in commemoration of the occurrence, among the archives of the Ducal Palace at Weilburg, where they now lie alongside of that which half a century before M. Blanchard deposited in like manner, to perpetuate the remembrance of a like event.

On the following morning, November 20th, at an early hour, we took leave of Weilburg and its hospitable inhabitants, and set out for Coblentz on our way to Paris, whither it was now determined we should proceed. At Coblentz, where we arrived late the same evening, it was our intention to purchase a carriage, and, having stripped it of its body, place the car containing the balloon and other accessories upon the springs, and in that guise, availing ourselves of the same conveyance, continue our journey by post.

This, with some difficulty and the delay of a couple of days, we at length accomplished, and by a proper adjustment of the contents, fixing a temporary seat athwart, and protecting the whole with a covering of oil-cloth, constructed, as we considered (how correctly will appear in the sequel), a very convenient retreat for the accommodation of such of the party as should be destined to enjoy it. Here also we parted from our companion Mr. Hollond, whose business requiring his immediate return to England, I gladly undertook to accompany the balloon to Paris.

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* See Appendix G., No. 1.

† Besides the usual national insignia, these flags displayed a series of allegorical representations descriptive of the rise and progress of aerostation. Independent, however, of any merit which they might possess from their execution or design, there was one circumstance in their history which rendered them invaluable in the eyes of the aeronaut; they had already performed two hundred and twenty-one voyages in the air, having been the constant companions of Mr. Green's excursions ever since his fifth ascent, wherein he had the misfortune to lose his balloon, and all it contained, in the sea off Beechy Head.

Accordingly, all our arrangements being, at length completed, early on the morning of the 24th, Mr. Green and myself again set out, intending to continue our journey night and day until we arrived at its conclusion. A series of misfortunes, however, appears to have awaited us from the very outset. The weather which had hitherto been particularly fine, considering the time of year, suddenly and completely broke up, and torrents of rain, accompanied by powerful and piercing winds, ushered in the morning of our departure. Its effects were soon but too perceptible upon our hastily-constructed equipage. In the first place our waterproof covering, but ill deserving the name, turned out no better than it should be; in short, anything but waterproof. Prepared merely with common size instead of varnish, the first half-hour's exposure to the rain completely divested it of every particle of dressing, and discovering a mere groundwork of canvass nearly as porous as netting, left us almost wholly unprotected to "abide the pelting of the pitiless storm." Gusts of wind at every step likewise poured in from all quarters, shaking our frail tenement to its inmost fastenings, and threatening every minute to deprive us of the nominal protection of the little covering which the rain had left us. To complete the comforts of our situation, scarcely had we quitted the town ere our seat, which had been too slightly constructed for the roads we were about to encounter, suddenly gave way beneath us, precipitately consigning us to the bottom of the car, where we lay for some time perdue among the various articles with which that part of the conveyance was plentifully bestowed.

As it was vain to think of trying to remedy these disasters in the country where we then were, our only alternative was to push forward as fast as we could, until we should arrive at some place where we might obtain materials to repair our shattered vehicle. It was not, however, till the conclusion of the second, or rather the morning of the third day, that we were able to accomplish this. At the village of Thionville, where we had been forced by the inclemency of the weather to pass the preceding night, we at length procured a quantity of common striped holland, the only stuff we could find suited to the purpose. With this we completely covered in the whole machine, and having caused it to be stitched down on all sides, except a small opening in front, whereby to creep in and out, extended ourselves at full length upon some clean straw, which served to separate us from the balloon and other articles beneath, and in that condition prosecuted our journey; to the no small delight and astonishment of all the little boys and girls that, at every stage we came to, and every village we passed, flocked in numbers to greet us; much edified no doubt by the spectacle we afforded them, though sadly at a loss to comprehend how a basket so heavy that four horses were scarcely sufficient to draw it, should have been able to convey us through the air to such a distance. In this manner, "Heu! quantum mutatus ab illo," we continued our route to the French metropolis, sorrowfully contrasting our present with our late conveyance, and indulging in many a comparison between the comforts of aerial and terrestrial travelling, much, it must be confessed, to the advantage of the former.

After journeying in this way for six long days and longer nights, we at length reached Paris, where new honours and a hospitable entertainment awaited our arrival.*

Thus ended an expedition which, whether we regard the extent of country it passed over, the time wherein it was performed, or the result of the experiment for the sake of which it was undertaken, may fairly claim to be considered among the most interesting and important which have hitherto proceeded from the same source. Starting from London, and traversing the sea, which mere accident alone prevented from forming a more important feature in our route, in the short space of eighteen hours we performed a voyage which, including only those deviations we have since been enabled to ascertain, rather exceeds than falls short of an extent of five hundred British miles.

It would be endless, as well as useless, to enumerate all the places of name or notoriety, which a subsequent examination of the map, aided by the reports of our appearance at different stations by the way, showed us to have either passed over or approached at some period or other during this extraordinary peregrination. A considerable portion of five kingdoms, England, France, Belgium, Prussian Germany, and the Duchy of Nassau; a long succession of cities, including London, Rochester, Canterbury, Dover, Calais, Cassel, Ypres, Courtray, Lille, Oudenarde, Tournay, Ath, Brussels, with the renowned fields of Waterloo and Jemmapes, Namur, Liège, Spa, Malmédy, Coblentz, and a whole host of intermediate villages of minor note, were all brought within the compass

* Among the other testimonies of honourable distinction which the various scientific and other bodies in that city conferred upon us in respect of our undertaking, I must not forget to mention the medal which was bestowed upon Mr. Green, by the Society of the "Académie de l'Industrie Française," for his ingenious discovery of the guide-rope, with the principles of which they expressed themselves perfectly satisfied.

of an horizon which our superior elevation, and the various aberrations we experienced, enabled us to extend far beyond what might be expected from a mere consideration of the line connecting the two extremities of our route.

To all this there was but one drawback, in the time of year in which the experiment was conducted, and which, by curtailing our daylight, devoted to the obscurity of night so large and interesting a portion of the expedition. Over this, however, we had no control; the constant occupation of the balloon for the purposes of public exhibition during the summer months, left no chance of its being procurable at a better season of the year, especially for a project such as ours, the determination of which as to time and distance was a matter of complete uncertainty. The excursion must therefore have been undertaken as it was, or altogether abandoned; of these alternatives Mr. Hollond unhesitatingly preferred the former.

Ere concluding this hasty narrative, a word or two is required concerning the success of that experiment which formed the main feature, as well as the chief object of the expedition. That object I have already stated to have been the verification, by proper trial, of the power of the guide-rope in determining the course of the balloon within certain restrictions, and the feasibility of its employment under every aspect of circumstances, to such an extent as to render it a valuable and efficient instrument in the hands of the practical aëronaut. In both these respects I have no hesitation in declaring the success of the experiment to have been complete, and the discovery itself one, the entire result of which, on the future progress of the art, it would be impossible at present to anticipate. With such an instrument as this, there now seems to be no limit to the powers of aërostation; no bounds to the sphere of action. All the theoretical objections which a hasty consideration of the means might otherwise have suggested, experiment has already proved to be erroneous; and, perhaps, the best illustration that can be afforded of the powerful influence which this discovery is capable of exerting in favour of the art is, that under its auspices and with all other advantages to the extent we enjoyed them on the late occasion, I should not feel the slightest diffidence in committing myself to the conduct of the winds, with the intention of continuing my voyage until I had completed in my course the circuit of the world itself.

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## MR. COCKING'S FATAL PARACHUTE DESCENT.

1837.—In August, 1814, Mr. Cocking gave a lecture on the true form of the parachute, before the City Philosophical Society, which was so well received that he was requested to repeat it before the Society of Arts, who, as a proof of their approbation, awarded him a medal. Twenty-three years had now elapsed, when, being doubtless incited by the success of the Nassau flight, he made earnest entreaties to be taken up with his parachute; and, by his importunity and self-confidence, he at length succeeded in obtaining the consent of Mr. Green, Mr. Hughes, and Mr. Gye, to this arrangement, which ended so unhappily for himself.

The following letter of Mr. Monck Mason discusses the whole subject in a public paper on the day preceding the ascent —

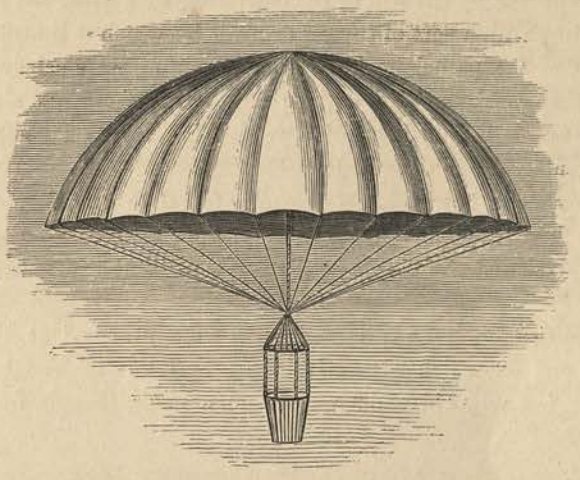
TO THE EDITOR OF 'THE MORNING HERALD.'

SIR,

In consideration of the forthcoming experiment, which I see announced for to-morrow, perhaps the following observations upon the subject of the parachute in general, and the merits of the two different systems which are now about to be practically illustrated, in particular, may not be thought unworthy of notice.

The principle of the parachute is so extremely simple that the idea must no doubt have occurred to many persons, of whom history, however, has failed to preserve a record. Even in the distant and half-civilised regions of Siam, Father Loubere, in his curious account of that country, published nearly two centuries since, makes mention of one who was wont exceedingly to divert the Court by his exploits in descending from great heights through the aid of such an instrument; a practice which we have reason to believe was not confined to that alone

of all the countries of the East. In Europe, however, no notice appears of any attempt to employ the parachute as a preventive against a too rapid descent through the atmosphere, till the year 1783, when a gentleman of the name of Le Normand first practically demonstrated its efficiency, by letting himself down from the windows of a high house at Lyons, of which city he was a native. The views of M. Le Normand with regard to its employment were, however, very limited, and do not appear to have extended further than its adoption as a means of escape from fire; nor was it till some time after, that the ingenious and speculative Blanchard first conceived the idea of applying it as an adjunct to the then new and interesting art of aerostation. This design he endeavoured to put into execution in an ascent which he executed at Basle, in the year 1793, having previously satisfied himself of its security by letting down dogs and other animals from various heights in the course of several aerial excursions undertaken from Strasburg, Lisle, and other places, during the several preceding years. In attempting to repeat the experiment upon himself, however, he was less fortunate; owing to some mismanagement, his machinery failed in its effect, and, coming to the ground with too great rapidity, his leg was broken in the fall.



M. GARNARIN'S PARACHUTE.

To André-Jacques Garnerin, who next followed in the career of the parachute, is due the merit, such as it is, of having been the first who ever successfully descended from a balloon by the aid of that machine. This he accomplished in an ascent from Paris, on the 22nd of October, 1797 (see p. 111), in the presence of the Court of France, and of an immense concourse of people, who had assembled to witness the adventurous experiment. At the height of about 2000 feet the act of separation was effected, and the balloon and parachute immediately started off in opposite directions. The former, however, was soon lost sight of, all eyes being involuntarily directed towards the descending mass, and all interest centred in the individual it contained. For a few seconds the consummation of his fate seemed to be altogether inevitable, the parachute obstinately retaining the collapsed position in which it had originally ascended. All of a sudden, however, it burst into its proper shape, and the downward progress of the adventurer appeared at once to have been arrested. The fears of the spectators now began to assume another aspect: the moment the parachute had expanded, the car of the aeronaut, which was suspended about twenty feet below it, shot out on one side with an impetus that almost brought it upon a level with the rest of the apparatus, and for an instant seemed to threaten the subversion of the whole. Recovering itself, however, by its force of gravitation, it soon re-descended, and swinging round to the opposite corner, commenced a series of violent oscillations, which for a considerable time seemed to render the issue of the experiment a matter of much uncertainty. As he approached the earth, however, these gradually became fainter, and although they never entirely disappeared, soon ceased to excite the immediate apprehension of his friends. At length, in about twelve minutes, he reached the ground, and was released from the parachute, without having experienced other injury than a feeble shock at the instant of collision, and a slight nausea which shortly after supervened, occasioned, it is supposed, by the unsteady nature of the movement to which he was subjected in the descent.

Shortly after this, Garnerin proceeded to England, where he made his third essay, in an ascent from North Audley Street, on the 21st of September, 1802, being the only one of the kind hitherto ever exhibited in this

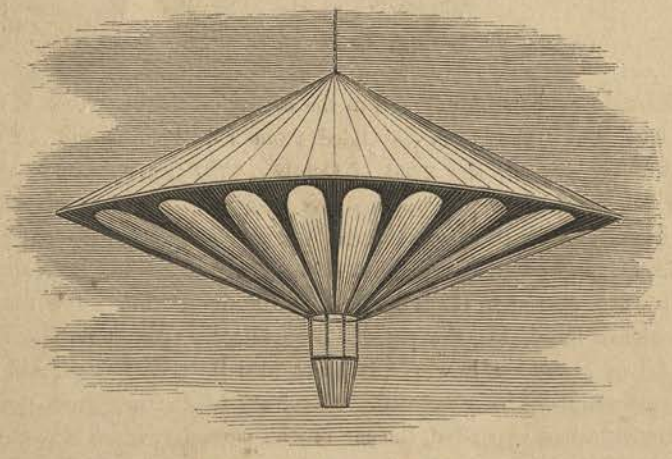
country. Since that period the parachute has frequently been made use of, both by himself and others, in various parts of the continent, always, however, for the purposes of public exhibition; nor, indeed, am I aware of any instance, except one, in which any absolute advantage has ever accrued from its employment: I allude to the case of Jordaki Kuparento, a Polish aeronaut, who, on the 24th of July, 1804, ascended from Warsaw in a Montgolfière, or fire-balloon. When at a considerable altitude in the sky, his balloon became ignited; being provided, however, with a parachute, he was enabled to descend in safety.

The principle upon which all these parachutes were constructed is the same, and consists simply of a flattened dome of silk or linen, from twenty-four to twenty-eight feet in diameter. From the outer margin all around, at stated intervals, proceed a large number of cords, in length about the diameter of the dome itself, which being collected together in one point, and made fast to another of superior dimensions, attached to the apex of the machine, serve to maintain it in its form when expanded in the progress of the descent. To this centre cord likewise, at a distance below the point of junction, varying according to the fancy of the aeronaut, is fixed the car or basket in which he is seated, and the whole suspended to the network of the balloon, in such a manner as to be capable of being detached in an instant, at the will of the individual, by cutting the rope with a knife, or, still better, by pulling a string communicating with a sort of trigger or pivot by which it is made fast above.

In the choice of the form of the parachute its original inventors were chiefly guided by the desire to obtain the greatest atmospheric resistance consistent with a given extent of surface; and although the form they did adopt may not be that which answers *exactly* to this description, yet it falls short of it so little as to more than compensate the deficiency by the other advantages which it affords.

Two objectionable circumstances, however, are generally found to attend the employment of the parachute as here described, namely, the length of time which is wont to elapse before it becomes sufficiently expanded to arrest the fall of the individual, and the violent oscillatory movement which almost invariably accompanies the descent.

In order to obviate these deficiencies a variety of plans were proposed at different times, amongst which is that now shortly to be tried, and for which I perceive the proprietors of Vauxhall Gardens claim the merit of originality. The idea, however, is a very old and a very common one, although, from certain inherent deficiencies,

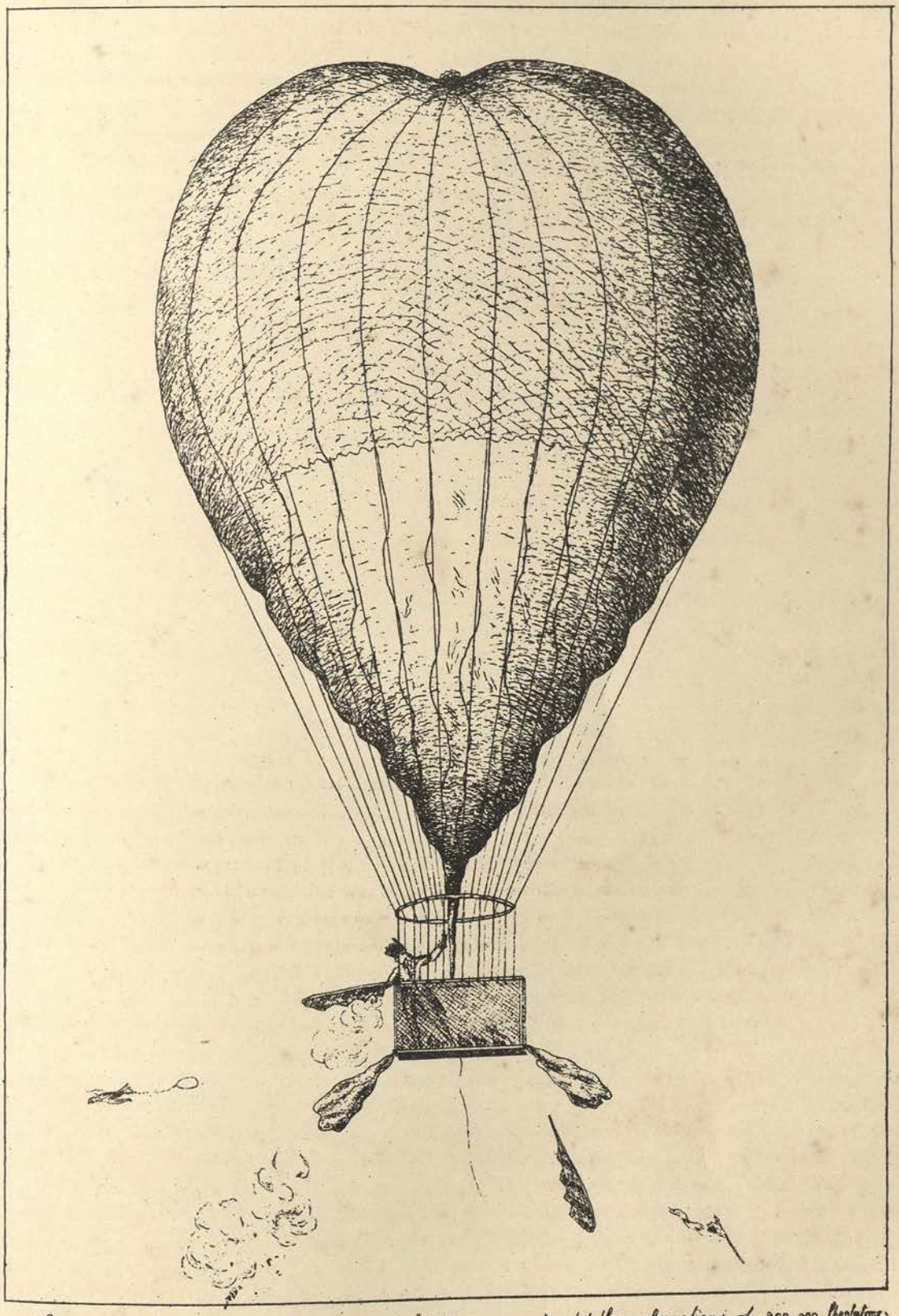


MR. COCKING'S PARACHUTE.

the practical cultivators of the art have declined adopting it. It was published in Paris nearly forty years ago, revived in England by Sir George Cayley, and communicated by him, with other interesting notices upon aerostation, if I mistake not, to the twenty-fourth volume of 'Nicholson's Journal.' It was subsequently more fully developed and improved by Mr. Kerr, by whom it was in several experiments practically and publicly illustrated, and is finally detailed in the 'Encyclopædia Edinensis,' at the conclusion of the article headed "Aeronautics."

The principle of the plan alluded to is simply an inversion of the preceding ones, in which the surface of least resistance is made to descend foremost, and so contrived as at all times to remain in a state of expansion. The precise form of that which is now announced for experiment is an inverted cone, somewhat flattened, to the apex of which is attached the car of the adventurer. The chief objects of this arrangement I have already stated to be the

# THE ENTERPRIZING LUNARDI'S GRAND AIR BALLOON,



Which took its flight from the Artillery ground, Sept.r 15 1784; Amidst the acclamations of 300,000 Spectators.
This wonderful Machine raised to the amazing height of near three miles; continued floating in the air for three hours.
and then alighted about 5 miles beyond Ware, in Hertfordshire, 24 miles from London.

Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c. Director.

correction of the oscillatory motion, and the insurance of the speedy action of the machine after its detachment: to the former of these, its shape was intended to conduce; to the latter, its state of permanent expansion. And yet, in seeking to obviate the irregularities in question by any modification in the form of the parachute, a great error has been committed, which nothing but an ignorance of their real cause could ever have occasioned. Indeed, these oscillations seem very much to have puzzled the aeronautical world, both here and elsewhere, and yet the grounds upon which they are accountable are extremely simple. Entirely independent of the form, the aberrations in question are merely the consequence of a first irregularity impressed upon the machine by the unequal expansion of its parts. In the act of opening, it is next to impossible that all the gores of the capacious dome should in the same moment attain the same degree of elevation; the side which is first opened to its full extent receives the first impression of resistance; the machine is thrown out of its equipoise; the irregularity which it first assumes becomes quickly transferred to the other side by the gravitation of the appended weight, and a reciprocal interchange of forces thus becomes established, which the atmosphere possesses but too little consistence speedily to subdue. Any attempt to correct these derangements by a modification of the *form* of the parachute is extremely futile; but to endeavour to do so in the way proposed is worse than futile: it is really to sacrifice the very principles of the machine to the attainment of an end to which the condition in question does in no way conduce. By a course of calculation founded upon the admitted axioms of dynamics (all of which are, in fact, the results of actual experiment), we learn that the resistance upon the base of a cone (supposing it a plane surface) is to that upon its oblique presentation in the proportion of unity to the sine-squared of half the vertical angle.*

Supposing the apex of the cone to be an angle of 120 degrees (from which, I have heard, it is not far

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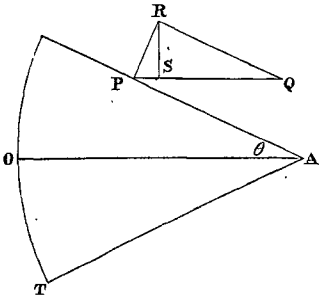
* The following investigation of the comparative resistance of fluids to bodies of different forms, is by my friend W. C. Ottley, Esq., Fellow of Caius College, Cambridge, and will not be examined without interest, especially, considering the disastrous event, the probable occurrence of which it was originally undertaken to elucidate:—

It is usual to calculate the resistance of fluids on bodies in motion upon the hypothesis of the particles of fluid leaving the surface of the body without impediment immediately after impact. This hypothesis is evidently incorrect in practice, inasmuch as the particles of air reflected from the surface must more or less interfere with those in progress towards it. It will be easily conceived that this effect must be the greatest when the surface on which the air impinges is concave, and that consequently it must generate a kind of compression in the concavity, which must much increase the whole effect of the resisting fluid. The increase of resistance arising from this cause will diminish gradually as the concavity diminishes, and will still be considerable when the surface is a plane; but whenever it becomes convex, the effect arising from this source becomes inappreciably small, from the facility with which the particles glide off after impact. These observations apply to that part of the effect which is disregarded in the mathematical calculations of the resistance of fluids; but it will be presently shown that even apart from these considerations, the resistance of the air upon a convex surface is considerably less than that upon a plane. To the mathematical reader this will be at once apparent; for the instruction of others, however, it may be as well to observe, that in the case of the plane the impact is direct, and consequently the whole momentum of the particles of air is exerted in resisting the advance of the body; whereas, in the case of the convex surface of a cone, the impact being oblique, only a certain portion of that force becomes effective in opposing its progress through the atmosphere.

It is true that the effect of the friction of the air against the convex surface of the cone would in some measure tend to increase this resistance, and that this effect in a cone with a very acute angle might considerably modify the required calculation; but in the case of a cone whose vertical angle is obtuse this effect may safely be disregarded, as more than counteracted by the circumstances just alluded to.

Proceeding to calculate the difference between the resistance on the convex surface of a cone and on its base, we shall find it considerable; and if, besides, we take into account the effect of the interference of the reflected with the impinging particles of air, we shall see how much there is in favour of the concave parachute.

Let PQ represent the force of a particle of air impinging upon the surface of the cone APT, in the direction of its motion. Then draw




PR at right angles to the surface of the cone, QR at right angles to PR, and RS perpendicular to PQ.

Then the effective resolved part of the force QP on the surface of the cone = PR = PQ sine RQP = PQ sine PAO = PQ sine $\theta$; and the part of this force resolved in the direction of the motion of the cone, and therefore effective in resisting its advance, will be represented by PS = PR sine PRS = PQ sine $^2\theta$, sine PR = PQ sine $\theta$.

Now, observing that the compactness of the impinging particles of fluid on any given portion of a surface will be proportional to the sine of the angle of inclination (sine $\theta$), and putting $\rho$ to represent the direct resistance of the air on a unit of surface, and $d$S to represent an elementary portion of the surface of the cone, we have $dR = \rho$ sine $^3\theta\ d$S; and if $y = ax$ be the equation to the line AP, and $s$ the length of the line, we have $dS = 2\ \Pi\ y\ ds = 2\ \Pi\ y$ sec. $\theta\ dx$

$\therefore\ dR = \rho$ sine $^3\theta\ 2\ \Pi\ y$ sec $\theta\ dx = 2\Pi\ \rho$ sine $^2\theta\ ydy$

$\therefore$ integrating $R = \Pi\ \rho$ sine $^2\theta\ y^2$,

Now the resistance on the base of the cone = $\rho$ multiplied into the surface of the base, because the impact is direct; $\therefore\ R = \rho\ \Pi y^2$. *Hence the resistance on the surface of the cone is to the resistance on the base as sine* $^2\ \frac{1}{2}$ *angle of the cone is to unity.*

Thus, if the vertical angle of the cone were 90°, then $\frac{1}{2}$ angle = 45°; now sine $45° = \sqrt{\frac{1}{2}}$; $\therefore$ sine $^2\ 45° = \frac{1}{2}$; $\therefore$ the resistance on the base of such a cone is double that on the surface. Again, supposing the vertical angle of the cone to be 120°; then $\frac{1}{2}$ angle = 60°; now sine $60° = \sqrt{\frac{3}{4}}$; $\therefore$ sine $^2\ 60° = \frac{3}{4}$; $\therefore$ the resistance on the base would in this case be to that upon the surface as 4 : 3.

removed), this proportion, it will be seen by reference to the note below, would stand in numbers exactly as 4 is to 3; thus indicating a loss of one quarter of the effect which would have been afforded by an horizontal area equal in extent to its base. Assuming, therefore, the superficial contents of this latter to be 908 square feet (as would be the case were its radius 17 feet, than which, however, it is something less), the power of the parachute in question to retard the fall of the individual would only be equal to that of a circular plane whose surface was 681 square feet.

The terminal velocity of such a parachute, or the rate at which it would reach the ground, is easily computed. From the experiments of Ferguson, Rouse, Smeaton, and others, on the accuracy of which the greatest reliance may be placed, we learn that the force exerted by the atmosphere in motion at the rate of one mile per hour, against a plane at right angles to the direction of its course, is in the ratio of ·005 of a pound avoirdupois for each square foot of surface; which force we are further aware increases directly as the squares of the velocities under which it is exercised. It is almost unnecessary to observe, that whether the atmosphere impinge upon the surface or the surface upon the atmosphere, the effect, as far as the question of resistance is concerned, is precisely the same.

Now, the weight of the above apparatus, inclusive of the individual himself, cannot, I am convinced, be safely computed at less than 500 pounds. I am aware that in the public announcements the weight of the parachute is stated to be but 223 pounds.* From the little acquaintance, however, which I have had with such experiments, I am perfectly satisfied that no machine of the alleged dimensions could be constructed, with the slightest regard to stability, in which the weight was under 350 pounds; and if to this we add 150 pounds for the individual himself, his ballast, and other equipments, I have no doubt we shall rather fall short of than exceed the reality. Upon this supposition, therefore, and assuming, as above calculated, a plane of 681 square feet to be equivalent to the parachute in question, we shall find a force of ·703 of a pound exerted upon every square foot; indicating, according to the scale before laid down, a rate of motion of about twelve miles an hour, or nearly eighteen feet in a second.†

To those who are not in the habit of forming an estimate of consequences upon data of the above nature, it will serve to give some notion of the force developed in such a proceeding, merely to suggest the consideration of the shock they would receive were they to be launched unprotectedly against a solid wall from the top of a vehicle travelling continuously at the rate of twelve miles an hour.

Nor is this a result peculiar to the above alone of all parachutes upon the same construction, or one which any arrangement of its condition with regard to weight and size could ever enable it to avoid. Owing to the perverse nature of the principle upon which it is contrived (all the forces which it encounters in its employment acting in direct opposition to the maintenance of its proper form), a degree of strength becomes necessary in its construction totally incompatible with the requisition of weight essential to the proper regulation of its descent. This is an inconsistency which it is impossible to reconcile by any means within our power. There is a certain limit in nature to the strength of materials, compared with their weight, which all the art of man can neither alter nor extend. In some cases this limit is very speedily attained; and I think it would not be difficult to prove that in this particular instance it falls far short of what would be necessary to answer the purposes in view.

With such an obstacle to contend with, I have no hesitation in declaring that no parachute can ever be constructed upon the principle in question that shall be capable of retarding the fall of man within the restrictions of speed necessary for his final preservation. No argument in contravention of this position, drawn from a consideration of experiments upon a smaller scale, is at all admissible. In comparative experiments of this nature there are certain elements which cannot be made to keep pace with the rest, and which, remaining always the same, utterly invalidate any analogy which it might be thought proper to institute between them. So long as the service required of them falls within a certain limit, there is no doubt of the success of their employment; the moment it passes that limit, one or other of these fixed principles begins to give way; nor can its place be either dispensed

* Some idea may be had of the loose manner in which a transaction, involving no less than the life of a man, was conducted, when we observe that in the public announcement, from which alone the world could derive any information on the subject, the weight of the entire apparatus, including that of the individnal himself, was stated to be but 393 pounds; whereas, from the evidence taken before the coroner, in the inquest upon the body of the unfortunate victim, as will be seen further on, it was made apparent that, after deducting 170 pounds (which, it seems, was the weight of Mr. Cocking), there still remained 413 pounds to be laid to the account of the apparatus alone; very nearly twice as much as that at which it was originally computed.

† The calculations, according to the formula of Dr. Hutton, which here followed in the original, give a result so nearly coinciding with that above stated, that we have thought it unnecessary to repeat them here. The terminal velocity, as computed upon these grounds, would have been 19$\frac{1}{5}$ feet in a second; somewhat greater than that deduced by the above.

with or supplied by any modification of the rest. On the contrary, any attempt to resort to such a remedy only tends to multiply the forces by which that fixed principle itself is really subdued.

If this is true in cases where the modifications alluded to are not necessarily more than are required for the end to which they are sought to be applied, as, for instance, where an increase in the quantity of material is merely made to supply a deficiency in its strength, it is doubly true where their introduction absolutely gives rise to circumstances by which a further increase in their amount is imperatively required. The manner in which this operates in the present case will appear the more readily when we consider that all the modifications in question, involving the increase of weight for the purposes of strength, are referable to the great hoop or upper framework of the machine tending directly to the derangement of its equipoise, and calling for the further addition of weight in another quarter, where it not only conduces nothing towards strength (the want of which it was originally introduced to supply), but actually operates to create a still further demand for it on its own account, necessitating the introduction of a further weight, and thus establishing a reciprocal alternation of cause and effect, under the operation of which the very deficiencies themselves are augmented by the means whereby it is sought to repair them. These are objections affecting the principles of the parachute in question, from which those upon the old construction are entirely free. In them the direction of the forces developed in the descent is exactly the most favourable it is possible to conceive, both as regards the retention of the form, and the maintenance of the equilibrium; rendering unnecessary all accessions of weight, save what are required for strength alone, and reducing even those to the smallest possible amount consistent with the actual cohesion of the parts. In the former, on the contrary, the tendency of all these is exactly the reverse; directly opposed to the maintenance of the form, the more they contribute to the retardation of the descent, the more they operate towards the destruction of the machine; while their chiefest force being exerted upon the outer edges of the superior surface, should the slightest inequality take place in their action, by which one side becomes operated upon more strongly than another, everything will favour the derangement of the equipoise, which nothing remains to check but the disposition of the weights themselves. In the present instance, this disposition is the most unfavourable to the exercise of such a restraint that it is possible to imagine. The parachute is stated to weigh 223 pounds; Mr. Cocking 177. It requires but little judgment to foresee how precarious must be the equipoise of a machine so constructed and so disposed. Even the advantage which the removal of the centre of gravity (which ought to be within the individual himself) would confer has here been neglected; placed in the very apex of the cone, the slightest inclination will be enough to throw his weight into the body of the parachute, and favour its descent in any way which the deranging circumstances may incline it to assume.

With regard, therefore, to the employment of the parachute in question, or, indeed, of any other that may be constructed upon the same principle, I have no hesitation in predicting that one of two events must inevitably take place, according to the special nature of the defect which may happen to be predominant; either it will come to the ground with a degree of force we have before shown to be incompatible with the final preservation of the individual, or, should it be attempted to make it sufficiently light to resist this conclusion, it must give way beneath the undue exercise of the forces it will necessarily develop in the descent.

Besides these essential objections to the projected parachute, there are others of minor importance, chiefly regarding its practical application, but which, all taken together, militate greatly against the prospect of its adoption as a convenient mode of regulating a descent. Among these, I shall only mention the difficulty in the first instance of attaching it to the balloon, especially if the wind should happen to be at all high, and the great opposition which it must necessarily offer to the ascent, owing to the permanent state of expansion upon the principle of which it is constructed.

All these disadvantages, the necessary consequences of its shape, are incurred for the sole purpose of avoiding a defect which does not depend upon the shape at all, and which would have been equally avoided by applying the principle of permanent expansion to the usual parachute, or even without any further alteration than by merely increasing the interval between the point of suspension of the individual and the plane of the resisting surface. This would not, it is true, diminish the extent of his deviation from the perpendicular; but by transferring it to a greater distance, it would diminish the angle of oscillation which it subtends, and obviate almost entirely its influence upon the parachute itself.

More might be said on the subject, but that the inutility of the invention does not excuse a further trespass.

M. M.

The newspaper account of the fatal result of Mr. Cocking's parachute descent is as follows:—

We regret to have to state that the experiment of the descent of the parachute has terminated fatally to Mr. Cocking. In consequence of the announcement that he was to ascend in his parachute suspended to the great Nassau balloon, a great number of persons, amongst whom were many of the first nobility of the country, assembled in the Gardens to witness the experiment. Without the Gardens, upon Vauxhall Bridge, and upon Millbank, the crowd was immense. Thousands of persons filled all the streets in the neighbourhood of Vauxhall, and a joyous crowd swarmed on every eminence and open spot that commanded a fair view of the horizon. The Thames was literally covered with boats, and presented an appearance of the most magnificent description. The time fixed for the ascent of the aeronauts was five o'clock; but on our entering the Gardens at that hour we found that the process of inflation of Mr. Green's Nassau balloon was not yet completed. This afforded us an opportunity of inspecting the parachute in which Mr. Cocking contemplated his awful descent, and we had some conversation with the unfortunate gentleman on the principle of his contrivance, and the altitude at which he proposed to sever his connexion with the balloon of Mr. Green. Mr. Cocking, who was a gentlemanly man, short in stature and somewhat stout, and apparently of the age of fifty-two or fifty-three, gave the most obliging answers to our queries, and explained that his parachute was constructed on a totally different plan from that of M. Garnerin. The latter he described as of the form of an umbrella, closed at the moment of descent, but expanded by the atmosphere as it approached the earth, and forming a sort of canopy over the aeronaut. His parachute, on the contrary, was in the form of an umbrella reversed, the cavity containing the air being uppermost, with the view, he said, of preventing the oscillation which proved so disastrous to M. Garnerin. As the parachute stood upon the ground, we were unable to see very exactly the place to be occupied by the aeronaut; but shortly afterwards it was raised to an altitude of about four feet, when we perceived a circular orifice of about a yard in diameter, to which a basket or car was attached by several cords. Mr. Cocking expressed by words the utmost confidence in the result of his experiment; but it appeared to us that it was a confidence which he did not feel. His restless looks and nervousness of manner seemed to belie the bravery of his speech; and we thought more than once that his mind was ill at ease, and that he would willingly have postponed the attempt until a less hazardous trial had assured him of its safety. When questioned as to the danger, he remarked that none existed for him, and that the greatest peril, if any, would attend the balloon of the Messrs. Green when suddenly relieved from the weight of himself and the parachute (about five hundred weight). Notwithstanding the confidence of this assertion, an uneasy twinkle in his eye convinced us that he was not so sure of this as he appeared to be.

The time which had elapsed since an attempt to descend by a parachute, and more particularly the novel construction of that which was exhibited, added to the perilous nature of the feat intended to be achieved, had combined to cause an unusual excitement in the public mind. Curiosity, however, induced all assembled to bear the delay which occurred with great goodhumour, and to attribute it to the right cause, which, in justice to Messrs. Hughes and Gye, the respectable proprietors of the Gardens, we feel it our duty to state was a laudable anxiety—First, That Mr. Cocking should not ascend, if he felt in the least degree doubtful as to his success; and, secondly, that if he did, every possible precaution should be taken, himself (Mr. Cocking) superintending, that no defect or oversight in any of the minutiæ should endanger his safety. So averse were they to be considered as urging him to the attempt, that at the last moment, and even for several days previously, they had not only endeavoured to dissuade him, but actually, when the preparations were concluded, offered to make an apology to the company, return the money paid at the doors, and take upon themselves all the consequences which might arise from the disappointment. Mr. F. Gye, who was particularly anxious in his attention to all the arrangements of the experiment, and who is entitled to every praise for the manner in which he exerted himself to prevent the possibility of accident, advised Mr. Cocking, if he felt the least timidity, to relinquish his attempt. Mr. Cocking, however, professed himself most anxious to carry his announcement into execution; and after thanking Mr. Gye for his kindness and solicitude, professed himself most eager to ascend.

Towards six o'clock Mr. Green and Mr. Spencer, the solicitor, entered their balloon, which was allowed to ascend to an altitude of about forty feet, that the parachute might be brought directly under it and securely fixed. It was seven o'clock before all the preparations were completed, at which time the whole apparatus was distinctly visible to every one in the Gardens. Considerable impatience had been manifested at the long delay which had taken place, but, as the position of the parachute became more clearly defined, a general clapping of hands expressed

the joy of the multitude. Another half-hour passed away, during which time Mr. Cocking was engaged in earnest conversation with several of his friends. The band of the Surrey Yeomanry suddenly struck up the National Anthem, which being considered the signal for the cords to be loosened, a loud huzza proceeded from the Gardens, and was re-echoed by the impatient mob outside. At this moment a tube or pipe of linen was lowered by the Messrs. Green from the car of their balloon through the orifice in the parachute, and past the basket in which Mr. Cocking was to sit. This, we soon discovered, was for the conveyance of the ballast it is found necessary to discharge on the ascent of a balloon, and which, if it had been thrown out in the usual manner, would have lodged in the parachute. All the preparations having been completed, Mr. Cocking (having previously stripped off his coat as too cumbersome, and put on a light jacket) stepped into the car amid the acclamations of the company. Some of his friends offered him a glass of wine, which he drank, and having shaken them all cordially by the hand, little knowing that it would be for the last time, the cords were loosened, and the balloon and its attendant parachute mounted into the heavens amid the renewed cheering of the crowd. The early part of the afternoon had been remarkably fine and clear, but about this time (half-past seven) the sky had become somewhat overcast, and a breeze had sprung up. No apprehensions, however, were entertained, and the scene at that moment was as gay and cheerful as it is possible to imagine. Above was the majestic balloon, sailing rapidly aloft, its inmates waving their flags in triumph; below was the gaily-dressed multitude, mixing their acclamations with the music of the band, and clapping their hands to the adventurous voyagers, little dreaming that the death-hour of the principal actor in the scene was rapidly approaching. The balloon, with the parachute, were visible for several minutes, passing directly over the Thames, and apparently taking the direction of Bayswater and Acton. Shortly afterwards they appeared to enter a cloud, and became lost to sight. The company began to separate, and, mingling with the crowds congregated around and in every avenue leading to the Gardens, formed a *tableau vivant* of high life and low life in not unfrequently amusing juxtaposition. All, nevertheless, seemed hieing homewards, impressed with different notions of the result; but the prevailing opinion, particularly amongst the humbler classes, appeared to be that some accident or misfortune would occur. We grieve at being compelled to turn from this scene of amusement and mirth, and record the disastrous conclusion.

Mr. R. Underwood, of Regent-street, followed on horseback in the direction taken by the balloon, to witness, if possible, the descent of the parachute, and from that gentleman we have learned the melancholy details which follow. Mr. Underwood was in the neighbourhood of Blackheath when he saw the Messrs. Green sever the cord which attached the parachute to their car. The parachute, thus left to itself, descended with the utmost rapidity. and swayed from side to side in the most fearful manner. Mr. Underwood immediately anticipated the worst. In a few seconds, the dreadful oscillations still continuing, the basket which contained the unfortunate aeronaut broke away from the parachute, and Mr. Cocking was precipitated to the earth from a height of several hundred feet. Mr. Underwood immediately spurred his horse, and arrived in a field near Lee, where several labourers had picked up the parachute. They would not believe that a man had fallen with it, but on Mr. Underwood's explanations, and an offer of five guineas to whoever should find the body of Mr. Cocking, they commenced a diligent search. After traversing four fields they heard groans proceeding from a field called Burnt Ash, near Lee, and on going in that direction they found the unfortunate Mr. Cocking literally dashed to pieces! and just as they were loosening his cravat he breathed his last in their arms. He was speedily conveyed to the Tiger's Head Inn, where four medical gentlemen attended. Their services were, however, needless.

A writer in a morning paper says:—"I was looking at the balloon with the parachute as it drifted steadily before a gentle wind and rose very slowly. After it was first pointed out to me, the parachute seemed to float without any oscillation, and to hang perpendicularly under the balloon. Shortly afterwards the balloon itself was slightly agitated, and was inclined considerably more to one side than when I first saw it, and the parachute did not appear to hang so perpendicularly as at first. While I was referring this to the balloon rising perhaps into a stratum of air with a somewhat greater velocity than the one it was leaving, the balloon and parachute adjusted themselves into their first position, and floated with as steady and as gentle a motion as before. In an instant afterwards I observed the balloon shooting upwards with great velocity, and the parachute, which had been suddenly separated from it, falling with great rapidity. I lost sight of the balloon, and my eye was fixed on the parachute. Knowing the use and object of a parachute, I was struck with the great velocity of its descent from the instant of its liberation. The sky was serene; the beams of the setting sun fell on the parachute, and every part was distinctly visible; the breeze in the region in which it was descending was so gentle as scarcely to exert any

perceptible influence in turning it from its perpendicular direction; and where I stood, perhaps about six hundred yards from where it alighted, the air did not move the leaves of an elm-tree. For a few moments the parachute descended so beautifully, and preserved its position so steadily, notwithstanding its fearful motion, that I thought it would reach the ground in safety; and I felt relieved from an intense momentary excitement, from an apprehension flashing across my mind, that perhaps some human being was perilling life itself in the experiment. Being ignorant of the real form of the parachute, I speak of it as it appeared from a distance. To my eye it had a round flattish shape, and at this moment it seemed to lean a little to one side: it was not horizontal. It remained for a moment or two in this position, all the while it was descending rapidly. It then fell, as it were, to the opposite side, but with a quicker motion than when it first lost its horizontal position. It now oscillated several times quickly. A sort of flapping motion was then perceptible, and the parachute appeared lessened in diameter. It then apparently turned over, and at this moment something fell out of it at a great height, which, for the instant I could keep it in sight, did not fall much faster than the parachute. The parachute again turned over, and, to me and some others standing near, it disappeared for the twinkling of an eye, and in the succeeding instant it was seen to have changed its flattish circular form to that of a long body, like an umbrella partially opened, or more correctly, perhaps, to a balloon very much collapsed, and descending with a great velocity. Some trees intervening prevented my further observation. I made my way through the fields in the direction in which I had seen it falling, and as I reached a spot at a little distance from where it fell I saw the lifeless body of the unfortunate gentleman placed on a hurdle, to be conveyed by some farm labourers to an inn at Lee."

### MR. GREEN'S ACCOUNT.

"In consequence of the sad and fatal catastrophe which has befallen the late Mr. Cocking, I feel myself called upon to communicate to the public the whole of the particulars of my ascent with the Vauxhall balloon, taking up with me Mr. Cocking in his parachute. The inflation commenced about twelve, under the able direction of Mr. Hutchinson, the engineer to the London Gas Company, and was completed by five o'clock. Prior to the parachute being attached to the balloon, I caused a trial to be made with a view of ascertaining whether the buoyancy of the latter was sufficient to carry up the former with safety. The result of this trial was, after some arrangements with respect to the ballast—of which I was compelled to give out about six hundred and fifty pounds in weight—had been effected, satisfactory. The abandonment of this large quantity of ballast I found to be absolutely requisite in order with safety to commence the ascent. The balloon was then allowed gently to rise a sufficient height to be conveyed over the parachute; but in consequence of the great and unavoidable delay which was necessarily caused in affixing the two machines, the gas in the former became very considerably condensed, from a reduction of its temperature. It thereupon became a matter of compulsion that I should get rid of one hundred pounds more of ballast, which I emptied out of a bag through a tube, constructed of canvas and about fifty feet in length. The object in having this tube was, that any ballast I might deem it advisable to throw out during our voyage should take such a course as would entirely clear the broadest expanse of the parachute.

The connexion between the balloon and parachute was at length completed by the rope of the latter being made fast to the liberating iron by which Mr. Cocking was to free himself from the balloon. It is but justice to myself that I should here state that I had on several occasions expressed my determination not to liberate the parachute from the balloon, upon the ground, setting aside my other considerations, that I might select a moment for the severance when Mr. Cocking was not altogether prepared or ready for his descent, and therefore if any accident were to accrue to him, that I, of course, should be regarded as the responsible party, and the one to whom blame would naturally attach. Mr. F. Gye, everything being in readiness, about twenty-five minutes to eight o'clock, gave the signal for the whole of the apparatus to be released from its trammels, and we instantly rose very steadily, taking an easterly course. Mr. Cocking had always ardently desired that we should ascend to an elevation of 8000 feet, about a mile and a quarter, at which height he proposed to detach himself from the balloon, and to commence his descent. Finding, therefore, that our upward progress was very slow, I requested Mr. Spencer to discharge some more ballast, and he accordingly threw the contents of a bag weighing twenty pounds through the tube already named. This proving of little avail, I directed a second and then a third bagful to be got rid of by the same means. At this period we were floating nearly over the Surrey Zoological Gardens, at an elevation of about 2000 feet. It was at this moment that a portion of the lower end of the ballast-tube became detached, a circumstance which was caused by

the occasional swinging to and fro of the parachute. This accident led to the inconvenience which I had foreseen some days before the ascent, and which led to the adoption of the tube, and of that of rendering it extremely difficult for us to discharge the ballast without its falling into the parachute. Our inability to do this, as we were then situated, I communicated to Mr. Cocking, adding that, under the circumstances, it was impossible for us to rise any higher unless we were to attempt to throw the ballast in bags beyond the outer spread of his machine—a course of procedure which we considered to be attended with much danger to any persons who might chance to be beneath—but that we would, if he wished it, make the experiment as soon as we had cleared the houses. Mr. Cocking replied, 'Very well; it is of no consequence, if you think I have time to rise as high as I want, and to descend before dark.' I remarked, 'I think you have, and you will then also have a more open country for the descent.' We now continued to glide along, guided by the pleasure of the wind, at nearly the same elevation, until we had cleared all the buildings. During this time Mr. Spencer and myself were busily engaged in dividing our ballast into small parcels, so that we might be able to throw them over without injury to the parachute. As soon as we found that we had arrived over the fields, and presuming that no danger could arise from the falling of the ballast, we quickly began to relieve ourselves of that essential commodity. In doing this, our anxiety respecting any of it lodging in the parachute was much relieved by finding that that machine continually swung backwards and forwards, evidently occasioned by the operation of the currents through which we passed, so that we were enabled, without any difficulty, to cast away the bags without damage to the vehicle immediately below us. We continued to discharge ballast until we had lessened our quantity by fifty pounds, in addition to that already sent over. The balloon now began to rise, and soon entered a tier of clouds, when we lost sight of the earth. So great, however, was the resistance offered by the parachute to this denser atmosphere, that we were again obliged, in order to attain the elevation Mr. Cocking pressed for (that gentleman considering that the greater the distance he had to fall the greater would be the atmospheric pressure under the parachute, and, therefore, the easier his descent), to rid ourselves of four hundred pounds more ballast, and even then we only arrived at the height of 5000 feet, which is a trifle less than a mile. We were still 3000 feet lower than Mr. Cocking's desired elevation. Whilst these operations were going on Mr. Spencer and myself held a conversation with our appended neighbour and friend, which was entirely confined to the progress we were making upwards, Mr. Cocking manifesting much anxiety and wishing to be informed how we were rising, requesting to know when every additional elevation of five hundred feet was accomplished. As soon as we had attained the height of 5000 feet I told him that it would be impossible for us to get up as high as he desired in sufficient time for him to descend by the light of day. Upon this Mr. Cocking said, 'Then I shall very soon leave you; but tell me whereabouts I am.' Mr. Spencer, who had a few minutes before caught a glimpse of the earth, answered, 'We appear to be on a level with Greenwich.' I then asked him if he felt himself quite comfortable, and whether he found that the practical trial bore out the calculations he had made. Mr. Cocking replied, 'Yes; I never felt more comfortable or more delighted in my life.' Shortly afterwards Mr. Cocking said, 'Well, now I think I shall leave you.' I answered, 'I wish you a very good night and a safe descent, if you are determined to make it, and not to use the tackle.' I should here observe, that with an anxiety to prevent any accident arising in the event of the violence of the wind rendering it impossible for a descent to be attempted, an apparatus had been constructed, under the direction of Mr. F. Gye, to afford us the facility of assisting Mr. Cocking to haul himself up into the car of the balloon, and that this is the tackle to which I thus alluded. Mr. Cocking to this question made no other reply than 'Good night, Spencer; good night, Green.' At this instant I desired Mr. Spencer to take fast hold of the ropes, and, like myself, to crouch down in the car. In consequence of being compelled to keep hold of the valve-line, of course I had but one hand which was available for the purposes of safety. With that hand, fortunately, in the perilous situation into which we were speedily thrown, I was able to maintain my position. Scarcely were these words uttered before we felt a slight jerk upon the liberating iron, but quickly discovered, from not having changed our elevation, that Mr. Cocking had failed in his attempt to free himself. Another but more powerful jerk ensued, and in an instant the balloon shot upwards with the velocity of a skyrocket. The effect upon us at this moment is almost beyond description. The immense machine which suspended us between 'heaven and earth,' whilst it appeared to be forced upwards with terrific violence and rapidity through unknown and untravelled regions, amidst the howlings of a fearful hurricane, rolled about as though revelling in a freedom for which it had long struggled, but of which until that moment it had been kept in utter ignorance. It at length, as if somewhat fatigued by its exertions, gradually assumed the motions of a snake working its way with astonishing speed towards a given object. During this frightful operation the gas

was rushing in torrents from the upper and lower valves, but more particularly from the latter, as the density of the atmosphere through which we were forcing our progress pressed so heavily on the valve at the top of the balloon as to admit of comparatively but a small escape by the aperture. At this juncture, had it not been for the application to our mouths of two pipes leading into an air-bag with which we had furnished ourselves previous to starting, we must within a minute have been suffocated, and so, but by different means, have shared the melancholy fate of our friend. This bag was formed of silk, sufficiently capacious to contain one hundred gallons of atmospheric air. Prior to our ascent the bag was inflated, with the assistance of a pair of bellows, with fifty gallons of air, so allowing for any expansion which might be produced in the upper regions. Into one end of this bag were introduced two flexible tubes, and the moment we felt ourselves to be going up in the manner just described, Mr. Spencer, as well as myself, placed either of them in our mouths. By this simple contrivance we preserved ourselves from instantaneous suffocation,—a result which must have ensued from the apparently endless volume of gas with which the car was enveloped. The gas, notwithstanding all our precautions, from the violence of its operation on the human frame, almost immediately deprived us of sight, and we were both, as far as our visionary powers were concerned, in a state of total darkness for four or five minutes.

"As soon as we had partially regained the use of our eyes, and had somewhat recovered from the effects of the awful scene into which, from the circumstances, we had been plunged, our first attention was directed to the barometer. I soon discovered that my powers had not sufficiently returned to enable me to see the mercury, but Mr. Spencer found that it stood at 13·20, giving an elevation of 23,384 feet, or about four miles and a quarter. I do not conceive, from the length of time I had been liberating the gas, that this was anything like our greatest altitude, for we were evidently effecting a rapid descent. This impression is corroborated by a rough calculation, which leads me to believe, knowing the customary rate at which the gas makes its escape, taken into consideration in conjunction with the length of time I had been pulling the valve-line, that we had lost at least 30,000 feet of gas, or 180,000 gallons, a total of 5000 feet more than my own balloon will contain. It may be regarded as somewhat surprising that not a larger quantity had evaporated, especially when the size of the valves is considered, that at the top being nearly three feet in diameter, whilst the one at the neck of the balloon is upwards of two feet. The reason, however, is easily explained. The extreme rapidity with which we ascended, coupled with the consequent pressure of the atmosphere on the upper part of the machine, necessarily prevented much escape from the top valve.

The same cause also forced an extraordinary emission from the opening at the neck, and I am decidedly of opinion, had it not fortunately happened that the proprietors permitted this latter valve to be increased from eighteen to twenty-five inches in diameter, that the balloon must have burst, and my companion as well as myself been hurled headlong into eternity. As I have stated, we were now rapidly on the descent, having got rid of all the usual annoyance to which I have referred; and finding that we were proceeding downwards with the ordinary calmness and steadiness, although with much speed, we hastened to empty two vessels of water which we had taken up for the purpose, and to charge them with the atmospheric air through which we were then descending. Our desire was to effect this object at our greatest altitude, but, from the circumstances which I have detailed, we were unable to accomplish that end, and when the vessels were filled the mercury in the barometer had ascended to 17·50, or an elevation of 16,632 feet, about three miles. When we had accomplished this matter, finding ourselves suffering severely from cold, we referred to the thermometer, which stood at 28, or four degrees below the freezing-point. We were at this period apparently about two miles and a half above an immense mountain of clouds, which presented the appearance of impenetrable masses of dark marble, whilst all around us was shed the brilliant rays of the setting sun. We continued to descend with great rapidity, and as we approached the clouds that velocity considerably increased. At this time so large had been our loss of gas, that the balloon, instead of presenting to our sight its customary rotund and widely-expanded form, now merely looked like a comparatively small parachute or half dome, without any aperture in its centre. We had parted with at least one-third of our gas, and were as far beneath the balloon itself as fifty or sixty feet. Recollecting the late hour at which we quitted Vauxhall, I now began to be anxious about the time, and, on applying to Mr. Spencer, ascertained that it wanted not more than a quarter to nine o'clock. From this I was aware, notwithstanding in our then position we were blessed with a magnificent light, that on emerging below from the clouds darkness would have assumed her sable hue over the earth, and that we should have much difficulty, therefore, in ascertaining the nature and character of the country, supposing us to be over the land, on which we must effect our final descent. I consequently became extremely anxious to make our way through the clouds as quickly as possible; which having done, we proceeded until we had reached within some three hundred feet of the

ground, when we found it requisite, from our inability to ascertain the nature of the ground, the whole country beneath us offering the appearance of thick woods, to cast out every article of ballast and moveable matters, even to ropes and empty ballast-bags, in order to prevent us from coming in contact with what was supposed to be trees. After calling out for some time, and hanging out the grapnel, we heard voices in reply, and the parties speedily drew us to a safe place of landing, which proved to be close to the village of Offham, near Town Malling, seven miles west of Maidstone, and twenty-eight from London. The balloon was packed, and conveyed in a cart to Town Malling, where we were most hospitably treated, and provided with beds by the Rev. Mr. Money, who, singular to relate, informed me that he is the son of Major Money, the aeronaut, who, on the 23rd of July, 1785, ascended from Norwich, and fell into the sea twenty miles off Lowestoff. At half-past ten o'clock this morning we quitted Town Malling, and it was not until our arrival at Wrotham, at which place I inquired whether they had heard where Mr. Cocking had descended, that I became acquainted with the unexpected and melancholy result of his experiment. I trust it is needless for me to say how deeply the feelings of Mr. Spencer and myself were harrowed up by the sad intelligence thus conveyed to us. It is only due to the late Mr. Cocking I should add, that throughout the whole of our voyage, up to the moment when he released himself from the balloon, he displayed the greatest courage and fortitude; and the expression of his features, and the light and joyous, although earnest, way in which he made his inquiries and conversed with us, manifested his great satisfaction that at length a theory to which he had devoted the last twenty-five years of his life was about to be triumphantly put to the test. We were up about one hour and twenty minutes. Individually, my opinion was, that, having withstood the difficulties and severe pressure of the atmosphere in its ascent, Mr. Cocking's parachute would accomplish its descent with perfect safety."

In reference to this unhappy event, Mr. Wise, of America, several years after, expresses himself thus:—

Looking at this contrivance with an unprejudiced eye, it struck me as remarkably ingenious, embracing none but true principles, adaptive to the end for which it was intended; and so confirmed was I in this conclusion (and am yet), that I would not have hesitated to repeat the experiment with a similar machine, with no other alteration than a tough wooden hoop in the top of it instead of a tin one, as was in his machine. I ventured this opinion in a Philadelphia newspaper at the time, and promised to demonstrate its truth, before the summer should pass by, by experiment with a true model of this new invention in letting down, from a great height, a living animal.

On the 18th September I ascended from Philadelphia with both a Garnerin and Cocking parachute attached. In the former I had placed a dog, and in the latter a cat.* The concave parachute was first dropped, which in two seconds afterwards commenced to oscillate with great violence, to which the dog, its occupant, gave the most ample testimony by a yelp, corresponding to each vibration, as far as I could hear him. Seeing it safely in the hands of some individuals below, the convex parachute was next put to the test. I made particular preparations to watch its whole descent, with a spy-glass for the occasion. When it was dropped it oscillated a little for a few moments, and then commenced describing spiral circles of perhaps a hundred feet diameter (this is a mere guess calculation, however), the parachute all the while revolving on its own vertical axis, which motion was in the same direction as its spiral motion; and thus it continued gyrating with a double motion, but apparently very smoothly and gracefully, until it reached the top of a dwelling in Eleventh-street, where it lodged safely, and was taken in from the dormer window.

Mr. Wise adds that, even with the defect in the upper hoop, that caused his parachute to collapse, Mr. Cocking would have descended without very serious consequences, by the friction of this vast surface through the atmosphere in a collapsed state, had he not lost his presence of mind, which caused him to receive the shock all at once.

I conclude this chapter with a relation of some other ascents made in America, by the same experienced aeronaut. The first took place in the presence of certain delegations of Indian tribes who were in Philadelphia.

In October, 1837, every arrangement being completed, the Indians, with the celebrated chiefs, Black Hawk,

and Keokuk the Prophet, and Black Hawk's son at their head, and the Florida soldiers, together with a numerous company of invited guests, being assembled for the occasion, at a few minutes after one o'clock, preparations for a start were made. Just at this moment the chief Keokuk, with the characteristic sagacity of the red man, requested me, through his interpreter, to allow him to make an examination of the whole machinery and apparatus. To this I cheerfully assented, offering at the same time to give him such explanations as he desired. It was evident from the manner of his procedure that he had some doubts as to the fairness and reality of what was to be done, apparently thinking that it was a sort of a juggle to be played upon them by a "pale-faced *medicine man*." Everything in the car was observed and scrutinised by him with a keenness that would have done credit to a philosopher. (Indeed, I looked upon him as a great *natural* philosopher.) A large brass speaking-trumpet that lay in my car elicited from him particular inquiry. Having just before told him that I would sail above the clouds, he asked me whom I intended to talk to there with this instrument. I told him it was intended to talk down, not up. He also inquired the particular use of the grappling-iron and the philosophical instruments contained in the car; the use of the latter he could not satisfactorily comprehend. He next asked permission to make a test of the *upward* power of the balloon, which was promptly granted him; several of the cords by which the machine was held down were brought together and placed in his hands. Upon these he gradually brought his weight, at the same time scrutinising the others that were fast to weights, whereupon he nodded assent and belief in its powers, and at once acknowledged an abandonment of his scepticism upon the affair. Black Hawk, who until then had maintained a sullen silence and apparent unconcern of the whole affair, called me to him and informed me that this affair was very interesting to his companions, but that *he* had seen such things before. This was the truth; for some years before he witnessed, in company with General Jackson, who was then President of the United States, an ascension from the Battery in New York. The Prophet and young Black Hawk listened and observed very attentively to all that passed, but made no inquiries, being apparently satisfied with what they heard.

This investigation being got through with, I shook hands, as a farewell, with the chiefs, and started off. At the moment of detaching the balloon the Indians all simultaneously sprang on their feet and gave a wave of the hand, with a faint but shrill shriek, which I took as a parting salute, and responded to it in a similar manner as nearly as I could.

I noticed on this occasion, while crossing the Delaware River at the height of a mile, that the water appeared much more transparent when viewed from that height than when viewed from a boat, or from its banks. And so remarkable was this phenomenon that, notwithstanding the muddled condition of that river in the vicinity of the place where it was crossed, I could trace the geological structure of its bottom for some distance above and below the point of crossing. After I had crossed the river, the balloon moving south of east, sufficient ballast was discharged to raise her 9000 feet high, when her course became due east, with a speed so moderate, that it was only by the change of topographical scenery that I could discern her onward progress. The day was a remarkably pleasant one for the lateness of the season, and at this immense height the thermometer ranged at 42°. It must, however, be observed, that the thermometer was not screened from the reflected heat of the sun by the balloon, which I afterwards discovered made a great difference in the indications of this instrument when carried aloft.

I enjoyed a range of vision from ninety to one hundred miles in diameter. Seeing that Philadelphia was now verging into the western horizon, and that Mount Holly and Vincent Town were passing beneath me in the same direction, and knowing that towards the east scarcely anything but forest and sea could now be expected, I commenced a rapid descent at half-past three o'clock, some distance to the east of Vincent Town. The first thing that obstructed me in this design was the contact of a whirlwind, which enveloped the whole machine in a cloud of dust, sand, and dry vegetable matter. This so tossed about the aerial ship that I was obliged to take refuge in the bottom of the car, the better to maintain my centre of gravity. After being thus swung about for a minute or two, and carried up and south-eastward for a considerable distance for so short a time, the whirlwind dispersed, and the balloon began to descend again. Having before this seen clouds of smoke ascending from the pines to the south-east of me, which I then took for collieries, I now found it to be the pines on fire, and the balloon fast descending right into it. Knowing the consequences of such a catastrophe from sad experience, the ballast yet remaining in the car was quickly disposed of. Finding this not to check the balloon sufficiently from falling into the fiery desert below, the speaking-trumpet and air-bottles had to follow, which fortunately enabled me to cross the conflagration. The balloon now rose again to the elevation of 3000 feet, and rapidly traversed the pines towards Barnegat Bay, and for a moment I thought of continuing the voyage to the beach; but when the heaving ocean showed itself in the eastern

horizon, swelling its bosom, as it were, up into the blue vaulted heaven, it looked to me like too much risk for the advantage likely to be gained by a landing on the beach sand. Consequently I determined to make a descent in the pines, which was accomplished at half-past four o'clock. The descent was made with considerable force; but the trees were so close to each other that the balloon did not slide down between until she was half discharged of her gas. Having before my descent kept an eye to the necessity of finding my way out of the fences, I rolled up the balloon, stowed it in the car, and then struck to the north for a road I had observed, which I soon reached. I also met some huntsmen, who assisted me in carrying the machinery to Burr's Saw-mill, which is thirty-eight miles from Camden and about forty from where I started.

## 1838.—The next ascent was at Easton, Pennsylvania.

Thus prepared, and the 11th of August, the day for the ascension, being at hand, nothing remained but to go on with the experiment. The day was fine in the morning, but at noon the heavens indicated an approaching thunderstorm, which, by ten minutes before two o'clock, passed over with no other injury than the wetting of the network of the balloon and the dispersal of a portion of the audience, who, for a brief space of time, were driven to places of shelter.

At a few minutes before two o'clock the balloon was detached from terra-firma. I had with me two parachutes containing animals—one a cat, the other a dog; and as the balloon approached a dense body of black thunder-clouds, some vivid flashes of lightning, accompanied by violent peals of thunder, greeted my upward passage. This gave the first part of my voyage a terrific, but grand and imposing appearance. It seemed to me as though heaven's artillery were celebrating the occasion as a progress of the new-born science, and it inspired me with a determination to try the new experiment of atmospheric resistance as a means of safe descent in the event of explosion of the balloon at great heights. As soon as an altitude of about 2000 feet was attained, the conical parachute, with its occupant (this was one on Cocking's plan), was detached, which landed in safety near Lafayette College, at the head of the town. Soon after this the balloon attained an altitude of about 4000 feet, at which point the oiled-silk parachute, with its occupant, was detached. This was to foreshadow the effect of the experiment of exploding the balloon, and was so contrived as to have an apparent disadvantage compared with that of the large machine. This small one was nothing more than a balloon in a collapsed state. When thrown overboard it fell some distance before it expanded completely, and after it had expanded it fell with a very irregular vibratory motion, which was not the case with the other one. Upon this I concluded, however, that the experiment would not be hazardous, if not disagreeable. I was also assured, from my experience, that a balloon in a flaccid state, or only partly so, would invert, that is, the lower part cave into the upper part, and assume a hemispherical shape in a rapid descent.

When an altitude of about 13,000 feet was attained, the balloon became fearfully expanded—to its utmost tension, and, having but an inch-diameter tube in the neck, the gas began to issue through this orifice with considerable noise. I would here observe, however, that any slight sound, occurring in so perfectly quiet a place as is that of a balloon a mile or two above the earth, makes apparently a great noise. At this period of the voyage it was evident that, unless gas were speedily let off, the balloon must burst from expansion; for she was still rising, and the explosive cord, being tied rather short, had also become tense, and must evidently be tending towards a rupture at the points where it passed through the balloon.

At this critical moment I became somewhat excited, and as I looked over the side of my car I observed the sparkling coruscations of lightning springing from cloud to cloud a mile beneath me, as the thunderstorm was passing its last remnants below. The storm was moving from S.W. to N.E. and the balloon was sailing from N.W. to S.E., passing New Village and Asbury, and I could now see the earth in that direction. I took out my watch, noted on my log-book the time—twenty minutes past two—and as I was about returning it to my pocket, thinking at the time whether it were not best to relieve the explosion rope, discharge ballast, and abandon, for the present, the idea of this experiment, *the balloon exploded!* Although my confidence in the success of the contrivance never for a moment forsook me, I must admit that it was a moment of awful suspense. The gas rushed from the rupture in the top of the balloon with a tempestuous noise, and in less than ten seconds not a particle of hydrogen remained in it. The descent at first was rapid, and accompanied with a fearfully moaning noise, caused by the air rushing through the network and the gas escaping above. In another moment I felt a slight shock. Looking up to see what caused it, I discovered that the balloon was canting over, being nicely doubled in, the lower half into the

upper; it had fallen, condensing the column of air upon which it was falling, until it had arrived at a point where it was so dense that the force of the whole weight pressing down on it was arrested, which caused the parachute to tilt over. The weight of the car, however, countervailed the tilting tendency, giving it an oscillating motion, which it retained until it reached the earth. The velocities of these zigzag descents were marked by corresponding notes of the wind as it whistled through the rigging of the balloon. On reaching the point where the lower current of air traversed the upper, another and more violent shock than the first was the result. From this point the oscillations became more severe, each one causing a sensation in me similar to that which a person experiences when dreaming that he is falling.

The wind from the S.W. drifted the machine several miles in its direction before it fell to the earth. As I neared *terra firma*, all the ballast was thrown overboard; but when I struck, it was with a violent concussion, for the machine was just then at its maximum velocity of descent. The car struck the earth obliquely, and I was thrown about ten feet forward from it. The balloon had fallen alongside of me, and so complete was the collapse where the lower part had doubled into the upper, that it was with difficulty separated again. The car had turned bottom upwards, and there I stood congratulating myself on the result of this exciting experiment—the perspiration rolling down my forehead in profusion, for the atmosphere below felt oppressive. The landing was made on the farm of Mr. Elijah Warne, about ten miles from Easton. Before many minutes had elapsed after this descent, I had resolved to repeat the experiment in Philadelphia at the first opportunity.

On my return to Easton, the day after the ascension I received the following letter:—

"Mr. Wise, Master of the Aerial: "New Village, August 11th, 1838.

"I hereby certify that my first sight of your air-ship was north of Henry Snyder's; it then apparently passed not far from William Kinney's, then directly between the inhabitants of New Village and the sun. We saw the gas rushing from the balloon like the steam from a boiler; it created between us and the sun the colours of a rainbow, and it was some time before we got a second sight, when you appeared to be lowering. As the size of the balloon became larger, we could discover a black spot underneath, about twenty feet. I pursued on foot until I saw you alight near Thomas Thatcher's.

"From your most affectionate, but not acquainted Friend,

"N.B.—And others." "William Sharps.

From this it appears that spectators on the earth could not see the balloon at the time it was falling during the collapse. Its descent for the first few seconds must have been faster than at any other period of its fall, and during that time it affected me more, too, for the sensation caused a dimness of sight, and I closed my eyes momentarily from the effect.

## First Ascent from Allentown:—

On the 8th of September, 1838, I made an ascension from Allentown, Pa. I had resolved, after this one was accomplished, to go to Philadelphia and repeat the experiment of exploding the balloon at a great height in the air. The Allentown ascension was a very complete one. The following extract from the journal, always kept during my ascensions, embraces the most interesting features connected with that trip:—

The balloon was now perfectly stationary over the outskirt of the town. I next concluded on starting a fresh interest to the spectators below. Having all the ballast bags filled with dust, several of them were emptied overboard, which for a moment enveloped the balloon in an artificial cloud, which presented a very interesting phenomenon to the lookers-on. This sent the balloon up about two thousand feet more, approaching at the same time a solitary cloud. As I passed the angle of reflection of this cloud a very sensible heat was felt, showing clouds to be good reflectors of heat, as they are of light. When the balloon got in proximity to the cloud it became somewhat agitated, making rotations one way, then another; at the same time the cloud apparently receded from the balloon, as by repulsion. Here several more bags of dust were discharged, which clung much more to the balloon than did the former; even the heavier particles were now attracted to the surface of it and remained there some moments. When the machine had risen considerably above this point the dust fell from it in a cloud. This was a very interesting part of the voyage, and convinced me that the sciences of electricity and meteorology would be much improved by the aid of balloons.

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c. Director.*

1864

Having arrived at Philadelphia in the month of September, immediately following my experiments at Easton and Allentown, I consulted several scientific gentlemen upon my intention to announce that I would make an ascension, and explode the balloon when over a mile high. Although they did not seem to doubt the philosophy of atmospheric resistance, nor the theory of converting the balloon into a parachute, still, they most earnestly attempted to dissuade me from my intentions, as they considered it a risk of life. Could they have persuaded me with half the philosophy against it that I had contemplated for it, it would never have been attempted by me.

Feeling convinced that all was right, an announcement was made that such an experiment would be made on the 1st of October, 1838, from the corner of Seventh and Callowhill Streets. The day was a remarkably fine one, and the balloon moved in five different directions during her flight. The editorial notices of five principal newspapers of Philadelphia will be first given, before I shall give my own account of it.

1st. "Mr. Wise ascended yesterday afternoon, at half-past four o'clock, with his balloon. The sky was perfectly clear, and the balloon passed slowly to the north-west; in about twenty minutes the rich blue of the heavens was marked with a thin filmy white, which was the gas escaping from the top of the balloon. At five o'clock, and for half an hour, we watched, at a distance from the city, the balloon far to the west, which resembled some large planet pouring out a flood of light. This was caused by the rays of the sun. The reflection was exceedingly brilliant, and the whole balloon seemed a ball of fire, while the hoop in the centre looked like a dark belt (it had no hoop in the centre). This was one of the most beautiful sights we have ever seen of the kind."

2nd. "Mr. Wise yesterday afternoon, as per notice, made an ascension in his parachute balloon, in the handsomest possible style. There was scarcely a breath of air stirring, and he rose almost perpendicularly to a great height, and was out of view at the writing of this paragraph, having been up about an hour. He went up without any difficulty—how he gets down we'll tell to-morrow."

3rd. "Mr. Wise, the aeronaut, made a successful ascension on Monday. The balloon passed over the Schuylkill, and Mr. Wise eventually descended, according to his promise, by letting off the gas gradually at an extreme height: by means of a cord and pulley he converted the balloon into a parachute, and thus came down. It was a most fearful undertaking, and was anticipated by competent scientific authority as calculated to carry with it destruction of life."

4th. "Mr. Wise made, yesterday afternoon, one of the most beautiful ascensions that Philadelphia ever witnessed. About half-past four he left 'old mother earth,' and like an arrow from a well-strung bow, reached the welkin, cheered in his upward flight by the shouts of the dense mass which filled the neighbouring streets. At six o'clock he was yet in sight, there being no breeze, and apparently in the *statu quo* of ten minutes after his departure. The explosion which was to make a parachute of his aerial vessel did not take place, owing, we suppose, to the fact that he could not get beyond the precincts of dangerous obstructions to such a daring attempt. At one time the appearance of the balloon was beautiful; the gas issuing from it seemed like smoke, and the sun shining upon the lower part of the balloon, which was considerably depressed, and exhibited a tremulous motion, gave it the appearance of being on fire. We did not learn where he descended."

5th. "Mr. Wise's ascension yesterday afternoon from the enclosure, corner of Seventh and Callowhill Streets, was one of the most beautiful we ever saw. We did not witness the process of inflation, as at the time of our entering the enclosure, half-past four o'clock, the pipes communicating the gas to the balloon had been withdrawn, and the aeronaut having entered the car, was arranging his cords and other fixtures. This was speedily accomplished, and at twenty-two minutes before five o'clock, the cord which confined the voyager to the earth was cut by Mr. Wise, and bidding the assembled thousands 'good-bye,' he soared aloft almost perpendicularly, though bearing a little south for some twenty minutes; after which, at a height of some several thousand feet, a different current of air wafted him to the north, until he was brought to a position almost directly perpendicular to the place of starting. At this altitude he encountered another current of air, by which he was rapidly carried in a west-by-north direction for several minutes, when a small cloud of gas was suddenly discovered to have issued from the balloon, and soon after another of about the same quantity; after which the object of attention seemed gradually to descend for a short time, until it had arrived at an atmosphere of sufficient density to exactly weigh it. It now pursued the even tenour of its way in a direct course, W.N.W., until nearly out of sight from the enclosure, when, at about half-past five o'clock, the balloon seemed suddenly converted into a parachute, and commenced a rapid descent. We watched its descent with a spyglass, until so low that the buildings hid it from our view, say at an angle of some ten or twelve degrees from the horizon. We know not at what distance from the starting-point the descent

was made, but should judge it to have been several miles. We hope, at least, that the intrepid voyager reached the earth in safety, though we had some fears from the apparent rapidity of his descent."

Such were the notices of some of the public journals of the day. They all but one agree as to the conversion of the balloon into a parachute, and that one saw it at the time it was forming into such a shape, when he perceived the depression in its lower part. In this last arrangement I had a pulley fixed into the valve disc, on the inside of the balloon, through which a cord passed, whose one end was fastened to the lower part of the balloon, by which that part might be drawn up into the upper as the gas rushed from the top. I found this part of the contrivance utterly useless. When the balloon was exploded, the lower part did not immediately invert, as in the former experiment of this nature, for on this occasion it burst open from top to bottom, and caved in sidewise. I was, at the first discovery of this, somewhat alarmed, fearing that it might come down with a continually accelerated velocity, from which anxiety I was, however, soon relieved. It caught the wind like the mainsail of a ship, and *slid* down upon the atmosphere, in a spiral course, with a *uniform* velocity. The descent was made a mile or two on the west side of the Schuylkill, and not less than several hundred persons had followed from the city, and were on the ground where and when it was made. The concussion was not near so violent as the apparent rapidity of the descent would seem to have warranted, and was not harder than that which would follow the jumping from an elevation of ten feet to the ground.

As the machine was descending, the lower part, one-third the length of the whole balloon, hung loosely in the network, swinging to and fro, and occasionally pressed upwards slightly by the current of air. The resistance of the machine against the atmosphere acted on the principle of the inclined plane, sliding obliquely down over it, describing spiral circles, until it struck the earth.

Since this experiment, balloons have exploded while aeronauts have been aloft with them, and in no instance have their persons been seriously injured; but every newspaper and periodical account set them down as miraculous escapes. And the miracle is always in the height from which the machine falls to the earth, the resistance that the atmosphere must present to it being never hardly taken into account. We might as well call the descent of the flying-squirrel from the high forest-tree to the earth, without sustaining any bodily injury, a miracle; for its surface, compared to its weight, is not in a greater ratio than is the weight of a man compared to the surface of a common-sized balloon, whatever shape the latter *can* assume.

This is a principle in aeronautics which has never yet been duly considered, although a very ingenious mathematical deduction upon the descent of parachutes has been given in this work. Meteorological and astronomical deductions are yet much to be facilitated by the science and practice of aeronautics. There are things in its philosophy that men have not yet dreamed of. There are sublimities in its practice that the world has not yet been fully prepared to realise.

Although the principle of atmospheric resistance is a self-evident thing, and its application to a safe descent from great heights has been demonstrated, there are yet very few persons who are willing to believe it so well established as to entitle it to be practised with impunity.

## 1839.—Second Ascent from Allentown:—

In the spring of 1839 I was invited to make another ascension from Allentown, Pa., which was readily accepted. The ascension was made on the 27th of April, at about two o'clock in the afternoon, and the following extracts from the log-book of the trip will be found interesting:—At twenty-five minutes past two o'clock my vessel stood over the town of Bethlehem, and had also reached the clouds, and the course changing from E. to S.S.E., the thermometer standing at 36°. This temperature felt unpleasantly cold; my ears began to ache violently, accompanied by a crackling, noisy sensation; my nose began to bleed, and I felt very much distressed for a few minutes. The balloon became rapidly distended, and highly electrified, and an open sack of sand lying in the car showed strong electrical effects by a portion of it being drawn up against the balloon, from which it would drop down again, keeping up this motion for over a minute. When the balloon left the earth the gas in it was of a milky colour, but now, when it had risen to a height where the machine had become fully distended by diminution of atmospheric pressure, so that I could look in through the neck of it, the gas had become perfectly transparent. While this change of colour in the gas was going on, it gave out water, which dropped freely from the lower orifice of the balloon, and it also emitted a strong sulphurous odour. Some powerful electrical effect must have produced

these phenomena, and I always found strong electrical effects when passing from one current of air into another.

On this occasion the wind was very strong when I descended, which was forty-two miles from Allentown; and having the explosive apparatus in the balloon, and failing in the first landing to get a hold with the grappling-iron, I found it very convenient to explode the machine the second time it touched the earth.

On my return to Allentown, the citizens of that place expressed a desire to have a third ascension. This was made on the last Saturday of May, 1839; and as it was attended by circumstances for a while placing my life in jeopardy, as well as bringing into use a mode of causing the balloon to descend which would seem paradoxical, an account of it will be here given. At the time it happened no particular account of the circumstances alluded to were given in the papers relating the voyage, for the reason that I was fearful it might *increase* the belief that ballooning was extremely dangerous.

At half-past two o'clock in the afternoon, everything being in readiness to detach the balloon from the inflating apparatus and prepare for the ascent, and just at the time this was all accomplished, and nothing more remained to be done but to draw the valve-cord out of the neck of the balloon, where it generally remains during the inflation, a gentleman from the South was introduced to me, who commenced a conversation, which drew my attention from the preparation of the valve-rope; and while conversing with him, I being in the car at the time, the balloon was let up the length of the restraining rope, where, after a few minutes of adjustment of things in the car, I bid him and all others a good-bye, and cut off the rope. The last fibre of the cord which held me to the earth had scarcely been severed, before the thought flashed on my mind that the valve-rope had not been secured. But it was too late now to remedy the mistake—the balloon was mounting rapidly. For a moment I began to despond, and I would have given everything possessed by me in the world to be down on the earth but one minute. It was an intensely painful moment; but I rallied my spirits quickly, took off my hat and swung it around, which was vociferously responded to from below.

I had with me a parachute containing an animal, and, knowing that the disposal of this would send me higher from the earth, I at first felt an inclination not to part with it; but upon reflection of its being announced to be done, and the people of course waiting for its descent, it was at once thrown overboard. I watched its progress until it reached the earth, when it was picked up by some men,—and oh, how I wished myself there, too! However, having over a hundred miles between me and the Atlantic Ocean, I felt hopes that something might be done in the interval that would enable me to get down. My first observation in view of this was to ascertain the velocity of the balloon in her eastward course. This was found to be about fifty miles per hour, and convinced me that the Atlantic was likely to be reached before the ascending power would give out, so as to let me down. I could not persuade myself that the balloon was in a bad enough condition to meet such a hope, for it had just undergone a thorough repair, and was in *good* condition,—a quality, in this instance, not very desirable. While thus meditating upon the best means of effecting a descent, I found that already a great portion of Jersey had been traversed, as Princeton was not far a-head of me. The current of wind below, just in the cloud region, was moving from the south-west, and the one the balloon was sailing in was from the north-west. To the north the atmosphere was clear; to the south it was charged with clouds. The lower current was carrying in it a thunder-gust, which presented a beautiful phenomenon. As I was over a mile above it, and four or five miles off, it gave me an opportunity to scrutinize its operations sidewise and above. The storm and the balloon were also moving towards the same point, so that I was continually nearing it, but so high above it that no danger was to be apprehended from its effects. The rain was pouring down from it, and made a noise like a mill-dam. The clouds were rolling over and against each other; the lightning flashing in zigzag flashes through them as long as their side-view was open to my sight. Presently, it was all overcast below me, the thunder rattling like small-arms without any of the rolling reverberations that are heard below. The most splendid part of this scene appeared just where the storm was passing some dense clouds that were moving in the upper current, that had recently made their appearance. Several times the surface of the lower stratum swelled up suddenly like a boiling caldron, which was immediately followed by the most brilliant ebullition of sparkling coruscations. Twice it swelled up, or rather shot up, like an immense pyramid, which was also quickly followed by an evolution of promiscuous flashes, and then quickly disappeared again, as though it had dissolved. It was a magnificent sight; but, in recurring to my critical situation, its charms passed from my mind with its departure to the north of me.

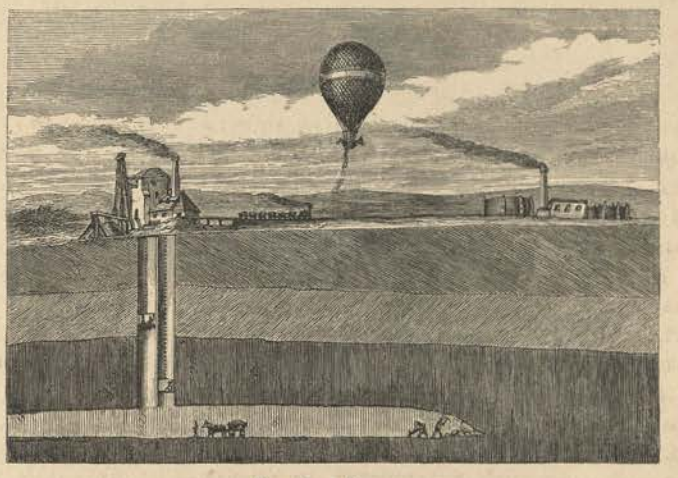
As soon as the storm had passed off, which was in about fifteen minutes, the sky became clear to the south

and east. Princeton was some distance to the north of me, and I was moving nearly due east. Less than an hour would now take me on to the Atlantic; it was already in sight to the north-east and the east. The balloon, seemingly, had not yet lost any of her altitude of the last hour. I had plenty of ballast to go up, but no control of the valve to get down. It was an embarrassing moment. First, I looked at my stock of provisions, which consisted of about a half-pound of water-crackers and as much cheese, together with a bottle of porter, which was handed me by a friend at the time of starting. This all seemed well enough to hold out with, even to cross the ocean, for, at the rate I had been moving, less than three days would take me across. But the balloon, good as she was, it could not be reasonably expected that she would hold out, although between forty and fifty pounds of ballast were to be depended on. The neck of the balloon, as is usual in common aerial voyages, was left open, and the natural affinity of gases for atmosphere must, in less than three days, so deteriorate the hydrogen in it as to bring it down. This hope now fled. What *was* to be done! A thousand things were running through my brain—even that of jumping overboard when on the confines of land, and plunging in the ocean. Faint hope! it were worse than sticking to the ship.

The proud and boundless Atlantic was now distinctly seen swelling its mighty crest to the arched roof of heaven, in the east, dashing its angry foam into the face of the clouds. This aroused all my energy, all my fertility of mind. I had been endeavouring to split my little flagstaff, in order to splice it and tie a penknife to the end of it, with which to cut the balloon; but it would not answer. My next effort was to burst the balloon by violent jerking of the car—the explosive rope was not in the machine now—but this also failed, and only went to show how immensely strong a network and balloon really were. Now a new idea flashed on my mind—*I can get down by going up*—and in another moment one bag of sand after the other went overboard, until half the ballast was gone; the balloon was mounting rapidly—the visible horizon was fast contracting—the yawning Atlantic was thus shut out of view. The atmosphere grew extremely cold at the height I had now attained; but the excitement of the occasion kept me warm enough. The balloon was now completely distended; the gas was copiously discharging itself at the neck, which, having no tube in it, was now open in a circle of eighteen inches diameter. As the gas mingled with the outer air it had the appearance of a white cloud. By violent jerks in the car, impulsive volumes were discharged from the neck, the balloon still rising. In ten minutes after I had commenced this the balloon had attained her maximum height, and immediately after began to sink rapidly. The valve-rope in the mean time partly rolled out of the neck, so that I could reach it with the flagstaff; my peril was at an end, and I felt as happy as Archimedes, when he cried out, *Eureka;* and I really *did* cry out, "Victory! victory!" as the threatening Atlantic came to view by the rapid descent. The immense discharge of gas, and the rapid admixture of atmosphere and hydrogen within the balloon, consequent to the free connexion by the large opening of the neck, and a rapid descent, brought the machine down to the earth fast enough without the use of the valve-rope, which had now been brought within my reach. Although the peril of perishing on the ocean was now ended, and I was almost in contact with *terra firma*, the old proverb of "misfortunes never come single-handed" was yet to be realized.

On reaching the earth, my grappling-iron took effect in a Jersey farmer's peach-orchard, which so alarmed a negro who was ploughing in the next field as soon to infect his horses, two boys, and two dogs near him, and to create a perfect bedlam amongst them. The horses ran away with the plough, snuffing the air like war-steeds—the boys screamed—the dogs barked—the horses snorted and reared up in the fence-corner—the negro lay on his back looking up in terror—the balloon was surging up and down, ripping the grappling-iron from one peach-tree to another. And now the contagion had spread to the house and the barn-yard, the poultry were in a clatter—the matron of the domicile standing before the door of the house, clapping her hands together in anguish for the safety of the boys, who were still screaming. The old man next made his appearance, with gun in hand, and in a gruff voice exclaimed, "Where is it, where is the d——d thing?" Terror next beset me, for a shot from the old man's blunderbuss was more than suspicious, the moment his eye should catch the balloon, to which his back was yet turned, and I made no delay in cutting in twain the grapple-rope. As the balloon rose, the old man cried out in a satisfactory manner, as he stood in a half-stooped position, "There, there it goes!" and I did go, although the country for two or three miles around was alive to the descent of the balloon, with footmen and horsemen wending their way towards it.

EARTH's children cleave to earth—her frail
Decaying children dread decay.
Yon wreath of mist that leaves the vale,
And lessens in the morning ray:
Look, how, by mountain rivulet,
It lingers as it upward creeps,
And clings to fern and copsewood set
Along the green and dewy steeps:
Clings to the fragrant kalmia, clings
To precipices fringed with grass,
Dark maples where the wood-thrush sings,
And bowers of fragrant sassafras.
Yet all in vain—it passes still
From hold to hold, it cannot stay,
And in the very beams that fill
The world with glory, wastes away,
Till, parting from the mountain's brow,
It vanishes from human eye,



THE COAL STRATA.

And that which sprung of earth is now
A portion of the glorious sky.—BRYANT.

They take very unprofitable pains who endeavour to persuade men that they are obliged wholly to despise this world and all that is in it, even whilst they themselves live here: God hath not taken all that pains in forming, framing, furnishing, and adorning this world, that they who were made by Him to live in it, should despise it; it will be well enough if they do not love it so immoderately, to prefer it before Him who made it.—LORD CLARENDON.

Look, the world tempts our eye,
And we would know it all.
We map the starry sky,
We mine this earthen ball,
We measure the sea-tides, we number the sea-sands.
We scrutinize the dates
Of long-past human things,
The bounds of effaced states,
The lives of deceased kings:
We search out dead men's words, and works of dead men's hands.

ARNOLD.

# CHAPTER VII.

## REMARKABLE ASCENTS FROM 1840 TO 1863.

Im einsamen Luftraum
Hängt nur der Adler und knüpft an das Gewölke die Welt.
Hoch herauf bis zu mir trägt keines Windes Gefieder
Den verlorenen Schall menschlicher Mühe und Lust.

SCHILLER.

Lo! where the eagle, his calm wings unfurl'd,
Lone-halting in the solitary air,
Knits to the vault of heaven this ball—the world!
And not a wind upon its pinion bears
One breath that speaks of human joys and cares.

BULWER LYTTON.

FIRST PROPOSITION TO CROSS THE ATLANTIC — A DOUBLE BALLOON ASCENT — "THE WARMTH OF THE VALLEYS REFLECTED" — EXPERIENCE SOMETIMES AT FAULT — A LADY'S DESCRIPTION — A WIND FROM WEST TO EAST CONSTANTLY FLOWING AT THE HEIGHT OF TWELVE THOUSAND FEET — WIDOW MONTGOLFIER IN GOOD HEALTH AT ONE HUNDRED AND SEVEN YEARS — COLONEL JOHN M'CLELLAN OF GETTYSBURG — THE AERIAL TRANSIT BILL — NAMING THE PLACE OF DESCENT — A TRANSATLANTIC PROJECT — A PETITION TO THE U.S. CONGRESS — HENRY COXWELL'S FIRST EXPERIMENTS — MONS. DEPUIS DELCOURT, THE EDITOR OF A PARISIAN JOURNAL — THE DANGERS OF A SOLITARY ASCENT — THE 'AEROSTATIC MAGAZINE' — A GENTLEMAN OF EIGHTY-THREE YEARS ASCENDS — MR. GREEN'S SECOND PROPOSAL TO CROSS THE ATLANTIC — THE LATEST NEWS FROM WEST CHESTER — HOW TO CAPTURE THE CASTLE OF VERA CRUZ — ALBERT SMITH'S FIRST ASCENT, SECOND ASCENT, AND PERILOUS DESCENT — A VIEW OF NIAGARA — A DESCENT ON LAKE ERIE — CROSSING THE SLESWIG-HOLSTEIN FRONTIER — TWO HUNDRED AND TEN MILES, THREE HOURS AND TEN MINUTES — FROM MARSEILLES TO TURIN ACROSS THE ALPS — THE DEATH OF LIEUTENANT GALE — MR. AND MRS. GRAHAM GRAZING THE GREAT EXHIBITION, MEET WITH AN ACCIDENT IN ARLINGTON STREET — MR. COXWELL RETURNS FROM GERMANY — HENRY MAYHEW'S ASCENT — KNIGHT'S EXPERIMENTS AT BOMBAY — MR. COXWELL'S PROPOSITIONS BEFORE THE CRIMEAN WAR — TWO HUNDRED AND FIFTY MILES, LONDON TO TAVISTOCK IN FIVE HOURS — THE CRYSTAL PALACE COMPANY — THE MEETING OF THE BRITISH ASSOCIATION — MR. COXWELL'S ZEAL IS EQUALLED BY MR. GLAISHER'S, THE METEOROLOGIST, AND MEMORABLE ASCENTS FOLLOW — THE HEIGHT OF SEVEN MILES IS ATTAINED — 'THE TIMES' LEADING ARTICLE — MR GLAISHER'S EIGHT ASCENTS IN 1862 — WINCHESTER TO HARROW IN SIXTY-SIX MINUTES — "COASTING IN A BALLOON" — BRITISH ASSOCIATION ASCENT AT NEWCASTLE — NADAR'S GÉANT — PARIS TO HANOVER — SEVEN HUNDRED AND FIFTY MILES, SEVENTEEN HOURS — GODDARD'S MONTGOLFIERE — AERIAL NAVIGATION IN CHINA — ASCENT AT PEKIN 1306 — THE CHINESE AERIAL EQUIPAGE IN 1860 — METHODS FOR DIRECTION — KNOWLEDGE OF THE WINDS — ATMOSPHERIC SOUNDING-LINES — OBSERVATIONS — DAILY TRANSMISSION OF METEOROLOGICAL OBSERVATIONS — MEANS AND INSTRUMENTS EMPLOYED BY THE CAPTAINS TO KNOW THE RAPIDITY OF MOTION AND THE DIRECTION TAKEN BY THE AEROSTAT — THE IMPROVEMENTS THAT MIGHT BE MADE BY A KNOWLEDGE OF ELECTRICITY — PRESUMPTION OF THE CHINESE — MY FIRST VOYAGE — THE AERIAL TERMINUS OF FOU CHEOU — THE TOWING-PATH — DESCRIPTION OF THE AEROSTAT AND APPENDAGES — THE SEAT FOR THE WATCHER — THE SEATS FOR TRAVELLERS — WE TAKE OUR SEATS — THE CENTRAL CABIN — WE ARE WEIGHED — WE ARE HOISTED — OUR TACKLE IS ADJUSTED, AND WE LEAVE THE STATION — TRAVELLING COMPANIONS — THE PASTIME OF THE LADIES — A CONSUMPTIVE MAN — A COMMERCIAL TRAVELLER — TWO OFFICERS OF THE IMPERIAL AERIAL FLOTILLA — THE PROJECTED VOYAGE TO THE POLE — FRANKLIN'S OPINION — CHINESE AERONAUTS FORBIDDEN TO COME TO EUROPE — A MOMENT OF ALARM — IN THE CLOUDS — THE STRIKER AND THE MARKER — CHINESE METHOD FOR MAINTAINING AN AEROSTAT AT A GIVEN HEIGHT WITHOUT LOSS OF GAS OR BALLAST: THE SAME WAS SUGGESTED IN FRANCE IN 1783 — MANŒUVRES FOR DESCENDING — THE POSSIBILITY OF APPLYING STEAM TO THIS OPERATION — THE EXPERIMENT OF GIFFORD IN 1852 — OUR ARRIVAL AT THE NANT-CHANG TERMINUS — THE TOWING CHARIOTS — THE BUILDING-YARD FOR THE CONSTRUCTION OF AEROSTATS — FAILURE OF LENNOX IN 1834 — BUREAUX DE RENSEIGNEMENTS — OUR CENTURY.

1840.—THIS year Mr. Charles Green announced his readiness to cross the Atlantic, and thus expresses himself with his usual calculation and forethought:—

It having been stated in several of the public journals that I had given it as my opinion that it would not be impossible to traverse the Atlantic Ocean in a balloon, and that in fact I was actually engaged in making arrangements to carry such a project into execution, I have thought it advisable, as well for my own credit as for the satisfaction of the public, to whom I gratefully acknowledge myself indebted for a long course of the most flattering patronage, to offer some explanation of the nature of the views I admit myself to have entertained upon the subject, and of the grounds upon which I build my expectations of success. With this intent I shall proceed to point out the principal obstacles with which I should have to contend in the attempt, applying to each the remedies which I have devised, and which I consider adequate to the occasion.

These obstacles, then (which, it may be as well to observe, are no more peculiar to the voyage in question than as being one of unusual extent and duration), naturally divide themselves into two classes; those, namely, which regard the maintenance of the power of the balloon throughout the period for which its services are likely to be required, and those which arise from the difficulty of securing the proper direction of her course.

With respect to the first of these, the reader is most probably not unaware that, apart from the leakage of the balloon itself (which, however, when in perfect condition, is not excessively material), a variety of circumstances attend its progress through the air by which, in ordinary cases, its power of sustaining itself becomes gradually impaired, and ultimately, of course, completely overcome. Of these one of the most formidable is the difficulty of making the balloon retain the same elevation in the atmosphere, and of avoiding those fluctuations in the level of its course by which it becomes subjected to the alternate exhaustion of gas by expansion, and consequent loss of ballast in order to furnish an equivalent dimunition of weight. The extent to which this condition of the art, exercised in the usual form, is capable of operating, will be more readily appreciated when we observe that, at an elevation of three thousand feet, the density of the atmosphere is nearly one-tenth less than at the immediate surface of the earth. The gas, therefore, expanding as it ascends, at that altitude occupies one-tenth more space than under its original pressure; a balloon, consequently, fully inflated at its quitting the ground must, ere it attain that elevation, part with such a proportion of its contents; and this, too, without taking into account any unfavourable change in the temperature by which it might, and probably would, be accompanied. To a balloon like that of Vauxhall Gardens, containing about 80,000 cubic feet, this loss would amount to 8000 feet. Now the average sustaining power of carburetted hydrogen, or coal gas, which I should employ on the occasion, is about thirty-six pounds weight for every thousand cubic feet; consequently the loss of power experienced in this slight ascent would be equal to 288 pounds; much more than would be lost by leakage from a good balloon kept inflated at the earth's surface in a week.

Again, at the approach of night, upon the passage through clouds charged with vapour, or under the influence of a shower of rain, a large quantity of moisture becomes absorbed by the balloon netting and other apparatus, frequently to the extent of two or three hundred weight, requiring an immediate discharge of ballast to that amount to prevent her being borne to the ground. As the morning approaches, or the influence of increasing heat begins to be felt, this moisture becomes dissipated, and, there being no means of collecting or recovering the discharged ballast, the balloon, lightened of her temporary incumbrance, rapidly rises in the air, her contents of gas expanding in her course, and rendering its liberation necessary to prevent the consequences we have before described. These alterations continuing to operate more or less frequently (at least once in every twenty-four hours), it need scarcely be observed, must very soon put an end to her power, however originally great, and forcibly terminate her progress through the air.

Such are the principal causes which affect the continuance of aerial voyages for any length of time, and the following is the means by which I propose to neutralise their influence. Across the hoop, to which, most readers know, the netting, which covers the balloon above and the car underneath are made fast, I have extended a cylinder or windlass, over which, and through a pulley likewise attached to the hoop at right angles to the windlass, passes a rope of sufficient strength, about two thousand feet in length, and being made fast at one extremity, remains suspended in the air to the extent at the time required. To the lower extremity of this rope are fastened at certain intervals a number of small stout waterproof canvass bags, the apertures of which are kept open by means of small rings of suitable material, in such a manner as, when drawn through the water, to admit the entrance of the fluid, but oppose its return. Between these, and likewise as stated distances, are also disposed a number of small conical floats of hollow copper, which are intended to serve the purpose of supporting the length of rope when it reaches the sea by the depression of the balloon. The operation of this apparatus it is

not difficult to perceive. As the balloon descends, under the influence of any of the causes before mentioned, the lower portion of this rope becomes gradually deposited upon the surface of the sea, lightening the balloon of its weight, until a sufficiency has been so disposed of as to arrest her further descent, when she continues her course at the same, or a very slightly varying elevation, until she acquires, by change of temperature, sufficient increase of power to enable her to recover her previous station in the skies. At this point, however, another force comes into operation. The small canvass vessels which, when the balloon began to sink, were empty, have now become filled, and being so much *additional* weight effectually prevent her, and oblige her to continue her course, even with her whole original power, at an altitude little removed from that to which at the lowest she was confined. How long she would remain in this condition would, of course, depend upon her own perfection: with such a balloon as I should construct for the occasion, I have no doubt that her elevation might be maintained for a period of three months should circumstances occur to require it.

Besides these advantages accruing from the use of this instrument, which has not unaptly been termed the "*guide-rope*," and the efficacy of which in its simpler form, even over the land, the reader may possibly recollect was tested in the excursion to Weilburg, there are others of great importance, which it may not be uninteresting to note here, although described in a previous work already communicated to the public. One of these is the means it affords the aeronaut of determining at all times with precision the direction he is pursuing; a knowledge which when out of sight of land, or of some fixed and definite object, he could by no means otherwise acquire. This it effects by the determinate position it confers upon the balloon in its progress: the guide-rope, retarded in its advance by its motion along the surface of the earth or sea, being always in the rear of the balloon, it is only necessary to observe its direction by the compass, and that of the balloon itself becomes at once indicated.

Another equally valuable indication afforded, and one which likewise is attainable by no other means, is the determination of the distance at which the balloon is at the time from the immediate surface of the earth beneath, when the view is obstructed by clouds or impeded by the shades of night. The importance of this information (which the scientific reader will at once perceive is entirely different from that afforded by the barometer, regarding only the elevation above the level of some fixed place) cannot be more clearly shown than by reference to the nocturnal voyage to Weilburg, when, without such a means of estimating our altitude, we should have inevitably been dashed against the mountains (and from the rate of our course, such a shock would most surely have been fatal); the barometer occasionally indicating an elevation of 3000 feet above the level of our original starting-place, while, owing to the rise of the ground over which we passed, the guide-rope, though only 1000 feet in length, was actually trailing upon the earth.

Having now explained, to the best of my ability, the means by which I expect to be able to maintain the ascensive power of the balloon throughout a much longer period than we have any reason to believe it would be required, even in a voyage of such uncertain duration, how to secure the proper direction of her course becomes the next object of our consideration. And this I propose to effect by taking advantage of the natural currents of air which my own experience and the observations of others—nautical men, skilled in the navigation of those particular seas, and men of science whose meteorological studies have enabled them to form conclusions upon the matter—justify me in expecting to find sufficiently favourable for my purpose.

These two sources of information, namely, my own experience and the observations of others, refer, however, to two distinct classes of currents; the former governing the motion of the atmosphere in its higher regions, and the latter the ordinary course or courses of the strata more immediately contiguous to the surface of the earth.

Many speculations having been started, from the first discovery of aerostation, regarding the probable condition of that portion of the atmosphere beyond the reach of our ordinary observations, I early made it an object to note the influence upon the course of my balloon of the currents of air which I might there happen to encounter. The result of my observations was the discovery of an uniformity in their direction so marked as to leave it almost impossible it could be the effect of accident, or otherwise than the natural and prevalent condition of the atmosphere in that portion of the ethereal space. Under whatever circumstances I made my ascent, however contrary the direction of the winds below, I uniformly found that at a certain elevation, varying occasionally, but always within 10,000 feet of the earth, *a current from the west, or rather from the north of west, invariably prevailed;* nor do I recollect a single instance out of two hundred and seventy-five, the number of my existing aeronautical excursions, in which a different result ensued. Now, though I do not mean to assert that such precisely must be the case over all portions of the terraqueous globe, yet I think I am justified in considering that

a condition not very dissimilar may characterise the more elevated regions of the atmosphere throughout its whole circuit.

With regard to the currents more contiguous to the surface of the earth, excepting that zone more particularly occupied by the trade winds, much uncertainty, no doubt, exists. That there are seasons, however, when the winds are addicted to blow from certain quarters, long experience has distinctly proved; and though, even at the most regular periods of the year, for any particular current, exceptions may occur to vary its direction, yet it seldom so happens that such an uniformity prevails throughout the whole body of the atmosphere, but that some part may be found to favour the particular course in view.

To enable the aeronaut to avail himself of such a combination is one, not the least of the advantages to be attained by means of the guide-rope. Having already shown its operation, in confining the course of the balloon to a certain level, I shall here only observe that the determination of this level within the limits of the guide-rope is entirely at his option; the effect of the windlass in curtailing or letting out the rope enabling him to depress or elevate the balloon at his discretion.

Should the direction of the atmosphere, however, be altogether unfavourable to the prosecution of his intended route, there is still one other expedient to which the guide-rope will enable him to have recourse, and which, though it cannot avail to stem the adverse current, will yet enable him to neutralise much of its injurious effects. This is the application of a strong *water-drag*, constructed on the principle of the umbrella or parachute, attached to the lower extremity of the guide-rope, and raised or lowered by means of a separate communication, whereby the speed of the balloon may be considerably checked, and her course delayed until a more favourable opportunity presents itself for once more abandoning her to the full influence of the winds. This water-drag being reversed by means of its own particular cord, and consequently collapsing, may be kept at all times attached to the guide-rope ready for immediate use.

From the foregoing statement regarding the prevailing direction of the winds the reader will now perceive the reason why I should have fixed upon America in preference to England as the point from whence the attempt should be made to traverse the Atlantic in a balloon. Whether the means I have here described be such as are calculated to produce upon his mind a conviction of their efficacy, it is not for me to determine. That they are competent in my estimation, I cannot give a stronger proof than by my readiness to undertake the excursion, should there be found amongst the wealthy patrons of the art any sufficiently disposed to favour the attempt. I need scarcely add that, for this or any other undertaking in which the interests of science or the advancement of the art I have so long cultivated are concerned, I shall be ever ready and most happy gratuitously to contribute my services.

A double balloon ascent from Philadelphia, in July, and two from the town of Chambersburg, in the course of this year, deserve to be recorded in Mr. Wise's own words:—

Everything being ready and the balloon filled, at half-past twelve o'clock, I proposed to Mr. Paullin that we should start and detach from the earth at the same time. Accordingly, the signal for the start was given, upon which I cut loose and ascended 500 or 600 feet before Mr. Paullin's balloon followed. It seems he was apprehensive of the balloons coming in contact if started at the same moment, an event which I had anticipated also, but had no fears of its consequence, on account of the elasticity of such bodies as balloons. When about a mile above the earth, Mr. Paullin's balloon approached so near to mine, being about fifty feet below and twenty or thirty feet to the west of me, that we could easily converse with each other. At the start I was standing on the board which served me for a car, but now I was sitting on it with my feet hanging down. Mr. Paullin hailed me, and said he was afraid his balloon would strike against my feet if he should suffer it to rise higher. It had been announced in the advertisement of the occasion, that the aeronauts would contest which should "stand *highest* in the estimation of the public." Mr. Paullin was of course desirous to mount above me, and his balloon being larger than mine gave him some advantage in that respect. I told him he should not get above me if I could get hold of his balloon, as I was determined to hold it down. It had now got very near my feet, and I was ready to seize it with one hand; the other was required to steady myself with, when it apparently glanced to one side and rose up by mine thirty or forty feet off. As Paullin passed, he cried out "Wise, it looks dangerous to see you sitting on

that board." I replied, "Never mind the danger, I'll be after you presently." His balloon now stood about 200 feet from mine and a little above me. He said, "What do you think of the sight?" I replied, "It is a magnificent one; do you see the Liliputians on the Delaware?" Paullin said, "I feel a breeze coming." His balloon now went up several hundred feet above the height of mine, and as I was intently watching its motion, I observed it suddenly agitated, so much that Paullin lowered himself in his car, for he had been standing up until then. His balloon shrugged up in the network, wrinkling it a little above where the network diverges from the silk, as though it had been drawn up under the net; and in another moment it shot off southward, immediately over the Delaware, at a velocity of a mile a minute, for a distance of five or six miles down the river. This phenomenon was the more remarkable, because my balloon was not in the least affected by it, though not 300 feet from Paullin's. It could not have been a general layer or current just above the place occupied by my machine, as I threw off some ballast, and my vessel rose up at least 2000 feet higher, without being affected by it.

This circumstance showed that a rapid current of atmosphere existed which was neither *wide* nor *deep*, as my machine was not far off in a horizontal direction, and crossed the path of Paullin's balloon at a right angle, but a few hundred feet above it, without falling into the rapid current. This is a meteorological fact that is not alluded to, if it is known by, the theorists of that science. There is an inseparable connexion between electrical and atmospherical currents. All my experience in passing through these currents traversing each other, has developed this fact.

While I remained almost stationary over the city for half an hour after Paullin's balloon had been drifted off, I perceived that he made several efforts to land; but as often struck the surface of the river, until, by going up again to a considerable height, he was drifted some distance over the river into Jersey, where he effected a dry landing some distance below Woodbury. Half an hour afterwards my descent was made near Red Bank, not much over half the distance from the place of departure that Paullin's was.

## The two ascents from Chambersburg, Pa., were in August.

1st.—Here the balloon shifted from a northerly to an easterly direction, the atmosphere becoming extremely cold. At this time the scene presented a sublime appearance. Around and beneath me the clouds rolled in majestic grandeur, occasionally rising into peaked summits, like volcanoes, and then dissolving down again into the mass below. The valley beneath, where it could be seen, presented the most gorgeous landscape scenery that I ever beheld. After rising about a mile and a half above the clouds, a most magnificent prospect of the country on either side of the mountains that enclose the Cumberland valley presented itself to my view. Looking over the North Mountain, the eye was greeted by a succession of valleys, rising up out of the earth as it were by magic, to the view, as the balloon rose higher, beautifully variegating the scene. The valleys had a lively colour, and appeared like circular pea-green bands laid down between dark-green plots of verdure—

> Like olive bound with laurels fast,
> Whose verdure must for ever last.

Looking over the South Mountain, the scene was entirely different. Here an extensive landscape was presented, circumscribed by rugged and massive clouds, interspersed with numerous roads which looked like so many white lines tortuously spread over its surface, and one which meandered from the base of the mountain upwards, until its further extremity was lost apparently in the clouds above, which formed the horizon of my view, giving to it a magic appearance. This mountain had a very different aspect from the others which were in view. Its dark foliage, interspersed with innumerable whitish-looking tortuous lines, being roads and paths, gave it a very unique but beautiful appearance. All this time I continued ascending by a gradual discharge of ballast, until the clouds had sunk so apparently low, as to hover immediately over the surface of the earth. The cold had now become intense, and yet the rays of the sun coming in contact with my person, caused a piercing sensation, like that from needle points, on those parts where it shone. I also suffered a violent pain in the ears, and joints of the jaws, followed by a slight dimness of sight.

At ten minutes before four o'clock, I descended on the farm of *Joshua Kanagy*. This old gentleman was so crippled with rheumatism that he was obliged to walk on crutches, and on these he hobbled towards the place of descent, where the balloon was fastened to an apple-tree by the grappling-iron, chafing and surging under a brisk

breeze that was blowing at the time; and the old gentleman seeing this, and also observing me at the same time in the car, and thinking that his assistance was necessary in the emergency, becoming more excited every jump he made with his crutches, until at length he became so impatient from his slow progress, that he dashed his crutches aside, and ran the balance of the distance between him and the balloon, with as much nimbleness as a hale young man.

2nd.—When I returned to Chambersburg, which was the same evening of the day the ascension was made, having landed only about twelve miles off, the citizens had already determined to induce me to make a repetition of the experiment, being so highly pleased with the one I had just made for them. This came off a few weeks afterwards, the day appointed for it bringing with it rain, which gave an entire new feature to the voyage.

At twenty minutes after three o' clock, the balloon was freed from her moorings, and described a semicircle in her upward course, making a half-tour round the town. The borough had a very sombre appearance, caused by the dark shadow which covered the earth—objects, however, were more distinctly visible than in clear weather, and this is always the case when looking down upon the earth from a balloon; where the sun shines on the earth there is more of a quivering haze covering it, than where it is in shadow. The scene below had a melancholy aspect—all nature seemed to be in a state of mourning.

Before I passed the limits of the borough, a parachute containing an animal was dropped, which descended fast and steadily, and just as it reached the earth my aerial ship entered a dense black body of clouds. Ten minutes were consumed in penetrating this dismal ocean of rainy vapour, occasionally meeting with great chasms, ravines, and defiles, of different shades of light and darkness. When I emerged from this ocean of clouds a new and wonderfully magnificent scene greeted my eyes. A faint sunshine shed its warmth and lustre over the surface of this vast cloud-sea. The balloon rose more rapidly after it got above it. Viewing it from an elevation above the surface I discovered it to present the same shape as the earth beneath; developing mountains and valley, corresponding to those on the earth's surface. The profile of the cloud surface was more depressed than that on the earth, and in the distance of the cloud valley a magnificent sight presented itself. Pyramids and castles, rocks and reefs, icebergs and ships, towers and domes; everything belonging to the grand and magnificent could be seen in this distant harbour; the half obscured sun shedding his mellow light upon it gave it a rich and dazzling lustre. They were really "castles in the air," formed of the clouds. Casting my eyes upwards, I was astonished in beholding another cloud stratum, far above the lower one; it was what is commonly termed a "mackerel sky," the sun faintly shining through it. The balloon seemed to be stationary; the clouds above and below appeared to be quiescent; the air castles in the distance stood to their places; silence reigned supreme; it was solemnly sublime; solitary and alone in a mansion of the skies, my very soul swelled with emotion; I had no companion to pour out my feelings to. Great God, what a scene of grandeur! Such were my thoughts; a reverence for the works of Nature; an admiration indescribable. The solemn grandeur—the very stillness that surrounded me seemed to make a sound of praise.

This was a scene such that I never beheld one before or after exactly like it. Two perfect layers of clouds, one not a mile above the earth; the other, about a mile higher; and, between the two, a clear atmosphere, in the midst of which the balloon stood quietly in space. It was, indeed, a strange sight; a meteorological fact which we cannot possibly see or make ourselves acquainted with, without soaring above the surface of the earth. Why is it that the cloud surface corresponded to the earth's surface? What causes two distinct cloud strata, one a mile above the other, in the sky at the same time? The elevated towers or projections that appeared in the distance on the surface of the lower stratum are common to the cumulus cloud, and on this occasion was beautified by the peculiar light cast through the upper stratum. But the distinct regions or vaults of clouds, and the lower one presenting in its upper surface the same irregularities as the earth, are questions for science yet to explain.

I remained in this magnificent heavenly mansion for an hour, and during that time did not move two miles in a horizontal direction, as it was perfectly calm and serene. The day was of a murky character; warm and rainy, and at the time the balloon entered the cloud region it was raining slightly, otherwise it had no peculiar characteristic. The lower stratum of clouds I judged to have been from 2000 to 3000 feet in thickness, as it took seven minutes in passing through. During the descent, and while in the cloud ocean, the sound of my voice produced a very distinct echo.

I made a final descent about five miles from Chambersburg, at thirty-five minutes past four o'clock.

1841.—In June, Mr. Wise's log-book has the following experiment:—

At thirty-five minutes past two o'clock I lost sight of Danville, and in a few moments afterwards passed into the clear sunshine above, in which the gas began to expand, and cause the balloon to ascend with increased rapidity. The Susquehanna was now lost to my view by the intervention of clouds, and the country beneath presented one vast wilderness as far as the eye could reach; the atmosphere was extremely cold for the height over this extensive coal region. The clouds beneath me were sufficiently broken to afford me constantly occurring glimpses of things below; and I never before found them so extremely diversified in their upper surface. On this occasion there were two strata, but not of that distinctive character which were met with in a former voyage. The lower bed was *cumulostratus*, resembling uneven and rugged precipices; the upper was more of a *cirrostratus*, and consisted only of patches here and there, but very high above the lower layer.

At forty-five minutes past two o'clock I crossed the Pottsville road between the Bear Gap and Northumberland road, travelling at the rate of about fifty-five miles per hour. At three o'clock I crossed Pottsville, and again brought to view the cultivated fields of the husbandman. My altitude was so great that I could not recognise the town until crossing Schuylkill Haven, and coming in sight of Orwigsburg. The cold atmosphere became so uncomfortable that it impelled me to descend; but after lowering some distance, I found the valley in which it had been my intention to descend had been passed, and the chain of Blue Mountains already reached, which required me to seek refuge in the clouds again.

At forty minutes past three o'clock the clouds began to thicken beneath me, so that at intervals I could only see the face of the earth. Perceiving a village, which the balloon was about crossing, I threw from the car a new bread-basket, which had been placed in it at the time of starting, intended to serve me as a temporary seat should I prolong my voyage. As it fell towards the earth it presented a beautiful appearance to my view; it had not gone far before it assumed a rapid rotary motion, bottom downwards, its upper being the concave side, looking like a beautiful rosette set into a circular motion on its centre. Its descent on the earth, as I was afterwards informed, caused considerable astonishment to several persons who saw it coming down; they not knowing anything of the balloon above them at the time. At four o'clock I passed the town of Reading a little to the west of it. This place had a handsome aspect; the white streets crossing at right angles, and the beautiful spires and domes, white as snow, with their glittering balls and vanes, made the prospect highly interesting.

I found the atmosphere much colder in crossing this mountainous region than it usually is in crossing over a level and cultivated country at the same height. During this voyage I observed a peculiar motion in the balloon, which had on former occasions drawn some attention from me, but which had not been closely investigated. It is this: When a balloon is sailing along with a steady current, while in equilibrium with the atmosphere, *it revolves slowly on its vertical axis.* This rotation is not at all times a smoothly-continued circulation, but is pulsatory, like the notched wheel in a clock which is actuated by the pendulum. At first I attributed this motion to my breathing, believing the vibration of the lungs sufficient to give a corresponding motion to so delicately balanced a thing as a balloon is when suspended in space. I held my breath as long as I could, and this was done several times; but the pulsations of the balloon were not interrupted by it; on the other hand, they seemed more audible during these experiments. Upon timing these pulsations, I found them to be every two and a half seconds, and this seemed to be regular as far as my observations indicated. This left me at a loss to account for this motion, as it seemed not to be caused by my breathing, and did not correspond to the beat of my pulse.

At twenty-five minutes past four o'clock I descended near the house of Mr. Wm. McIlvain, near Morgantown, about seventy miles from where I started, in a straight line, where I was cordially received by this gentleman and his hospitable lady.

My landing here was caused by mistaking the Downington turnpike-road for the Pennsylvania railway, which was some eight or ten miles farther to the south. During this voyage I also distinctly felt the difference in temperature in crossing large valleys, where a degree of warmth rose up quite congenial to one's feelings while in a frosty region. This, I presume, arises from a greater quantity of the sun's rays being reflected upwards from a valley than from level ground. I forgot to mention that the pulsatory motion of the balloon was not perceptible when it was rising or falling, and is only to be detected when the machine sails a considerable length of time at a great altitude in a steady, horizontal direction. Fluctuations of the balloon by rising and falling from any cause soon neutralise this delicate motion.

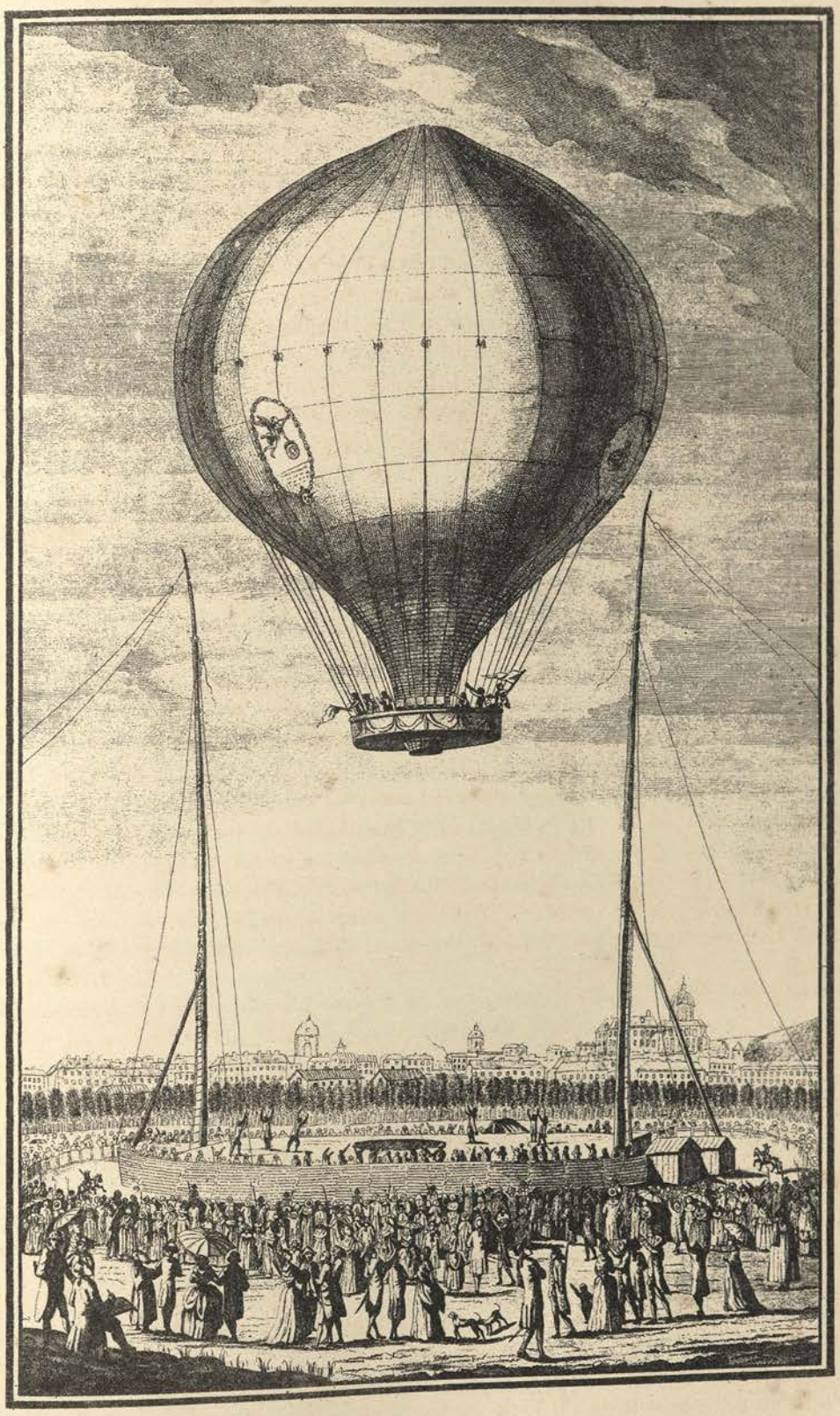


*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Heldsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director.*

1864

This account of a perilous descent is given to show that even the great experience of Mr. Charles Green could not always render him proof against such casualties :—

On the occasion of a fête at Cremorne House, Chelsea, for the benefit of the Polish Refugees, Mr. Green and a gentleman named Macdonnell ascended with the Nassau balloon, and the following description of the aerial trip by the latter gentleman will be perused with interest :—

It was about five minutes after seven when Mr. Green (with his Liberator, as he calls it) finally let loose the last links that bound the balloon to the earth. We immediately ascended with a swift and steady motion till we attained the height of about 1500 feet, at which elevation we continued to move with considerable velocity till we found ourselves over the Isle of Dogs, when, throwing out some ballast, we rose many hundred feet higher, and were borne in a south-easterly direction towards the centre of the county of Kent. Here, at Mr. Green's desire, I threw down occasionally several pieces of paper in order to ascertain whether we were rising or remaining at a stationary height. Soon afterwards Mr. Green drew my attention to the smoke of the many steamers which were passing to and fro beneath us, and which was evidently blown in a north-east direction, towards the county of Essex. Accordingly he thought that by descending into the under-current which was blowing towards that county he might effect a descent where there were fewer woods and orchards to obstruct or endanger our progress. The result justified his expectations; for when, by letting out more gas, we had drawn nearer to the earth, we found that we were approaching the Essex side of the Thames. About two miles before us lay a large extent of champaign country, called the Salt Marshes, which appeared to afford the requisite facilities for a safe descent. Mr. Green made his preparations accordingly by letting out the gas from the upper valve, and we descended swiftly to the earth. In a few seconds we passed over the Thames, and found ourselves about two hundred feet above the ground at the opposite bank. Here Mr. Green cautioned me particularly to take fast hold of a rope, which he had fastened across the wicker-car; and luckily I obeyed his instructions to the letter, for presently we felt a slight check from one grappling-iron let down from the hoop above to the distance of 140 feet towards the earth. A moment after there came a terrific shock; we were going at the rate of at least sixty miles an hour, and our anchor caught in the side of a dike, and, owing to the extreme speed with which we were travelling, tore its way through the hoop to which it was fastened, and, coming in contact with the car as it snapped, completely upset it, so that I and Mr. Green were turned topsyturvy, with our heads towards the ground. The rope which was passed across the car alone prevented our falling out; though so complete was the upset, that most of the contents of the car, such as the ballast, &c., as well as my own hat, dropped to the earth. In another moment the car righted, and the balloon, thus freed from every check, descended, dashing us with terrific force against the ground.

Immediately afterwards it ascended, and again brought us with a fearful collision to the earth. The wind was blowing with violence, and we were thus carried along for upwards of half a mile, till at last we reached a sort of creek or small river, through which we were hurried half-buried in its waters, to the opposite bank, over which we bounded like a tennis-ball, and, after a few moments, found ourselves dragged through some acres of marsh and osiers towards a high mound, which I confess that I contemplated with fearful anticipations of the result. But onwards, still onwards, the terrible demon to which we had linked ourselves held its way. Ere long we were dashed against it, and then carried over it right upon a strong paling that lay at the other side; but nothing could withstand our impetuosity, and we burst through the oaken timbers as though they were cobwebs—not, however, I regret to state, without Mr. Green sustaining some very severe internal injuries. We had now a level plain before us, and the speed of the balloon was beginning to be arrested by the great escape of gas; for we constantly, through all the vicissitudes of our fortune, kept a tight hand on the rope which opened the upper valve. Here a comical sight presented itself, if anything can be reckoned comical to persons situated as awfully as we were. There were large herds of cattle grazing in the plain, who, when they perceived the balloon approaching, at first formed themselves into a compact body, as though to resist an invading enemy; but on our nearer approach fled panic-struck before us. Never was seen such an extraordinary chase: we dragged along the ground fastened to a monster that seemed to disdain all human guidance, and chasing a herd of cattle, who fled in terror, with their tails in the air, and their heads to the ground. Ere long I found means to throw myself out of the car without sustaining any material injury, and seized hold of one of the ropes, which I twined round my left hand, as I was apprehensive that the balloon, when lightened of my weight, might bear my fellow-adventurer on a second reluctant

visit to Nassau. The rope cut through my flesh nearly to the bone; but I managed to hold on till a countryman came to my aid. Need I enter into any more details? Suffice it to say that we found ourselves near Rainham, in Essex, having accomplished that distance from Cremorne House, Chelsea, in less than twenty minutes. The peasantry, who soon congregated about, rendered us every assistance; and mine host of the Phœnix, in Rainham, contributed all he could to revive and recruit Mr. Green, who was rather seriously indisposed, and is, I am afraid, hurt internally.

Mr. Green says of this voyage :—

Highgate, August 18.

Having been in the atmosphere about fifteen minutes, our descent took place at twenty minutes past seven, P.M., in a large marsh in the parish of Rainham, in Essex, after crossing the Thames four times. The distance, as near as may be, from Cremorne House, is about twenty miles. On no former occasion of my numerous ascents have I ever had to contend with so violent a wind as raged—in fact, it was only a very short time before we ascended that there was an abatement of its force. Notwithstanding that the spot selected was very well adapted to effect a descent, being extensive, open, marsh land, I never experienced so rough a landing. The first time the grapnel took a firm hold the shock was so violent, in consequence of the state of the weather, that the hoop to which it was attached, and which had been used by me and my son in no less than 313 voyages with success, broke, depriving us of the grapnel and cable, both of which had been left behind firmly fixed in the object to which the grapnel had caught—a bank. We were then dragged about a mile and a half over the earth's surface in the space of three minutes, by which time nearly the whole of the gas was expended, in consequence of our never abandoning the care of the valve-line. We received several severe shocks and concussions in passing over dikes, banks, and fences, and a strong paling, through which the car tore its way by the velocity of its motion. This illustrates in a new form that fact in natural philosophy, that a comparatively soft body like our flexible wicker-car, when in very rapid motion, will force its way through a hard one without itself suffering material injury. I am happy to say we eventually escaped, but not without some severe bruises: we did, indeed, get some hard knocks. Had it not been for the determined courage of my companion, to whom I had the honour of being introduced by Lord Dudley Stuart, who himself made a voyage with me on a former occasion, the descent must have been attended with most serious consequences. I understand that one of the reports in circulation is, that the injuries I have received are of such a nature that I must abandon the profession of an aeronaut. Permit me to say that I hope to disprove this report by making an aerial voyage from the New World to the Old, taking advantage of the prevalence of the westerly winds, as soon as I shall have constructed the kind of balloon which I know to be necessary for that purpose.

CHARLES GREEN.

A lady wrote this letter to the editor of the 'Weekly Chronicle,' in September, 1841 :—

DEAR SIR, September, 1841.

Agreeably to your desire, and not without considerable reluctance, I sit down to endeavour to give an account of our delightful voyage, but deeply regretting that my power of pen will produce but a feeble portrait (I am speaking as a portrait-painter) of all that was calculated to command our admiration of nature through the medium of art, and of one so well adapted to effect such an object as that stupendous machine, the Nassau balloon. In pursuing my narrative, you will excuse me if, as the gentlemen of the press, I assume the privilege of writing in the plurality of persons, by using the monosyllable *we*. The evening was delightfully calm, the heavens beautifully serene, and of that lovely blue which the Italian masters have so delighted in transferring from their own sunny skies, speckled over with numerous light and fleecy clouds, and scarcely a breath of wind stirred. By veterans in aerial voyages it was considered that a more favourable evening for a trip could not have been selected. From some misunderstanding, however, the inflation was but partially performed. It certainly robbed the balloon of a great portion of its majestic appearance; but whether from parsimony or for other reasons it matters not. It did not rob Mr. Green of his skill, so that he could not bear up and rise above the difficulties thrown in his way. At ten minutes past seven Mr. Green completed the act of separation from our friends, and

we embarked, impressed with loftier views and every prospect of a pleasing voyage, taking a north-easterly direction, which current, with but little variation, bore us throughout. It is utterly impossible for persons on their first adventure to give expression to their feelings. There is something awful in the very novelty of the situation that, to a great degree, paralyses the language of description, and yet the awe may be considered imaginary; for the balloon that Benjamin Franklin recognised as a boy appears to have reached its manhood.

On leaving the gardens we were somewhat flattered by the cheers of those we left behind us, and they changed notes in proportion as we towered over the lanes and thoroughfares adjoining. The motion of the machine was so imperceptible that it seemed not to us as if we were leaving the gardens, but as if the gardens left us. The first blush of observation presented to us a something like a schoolboy map—everything flat, diminished in dimensions, and curiously compact. The motion of heads, and the turning up of faces, partly indicating animation, but more especially reminding us of bas-relief sculpture. We soon triumphantly o'ertopped the orientalists of the metropolis, and then the scene changed shades, and assumed a different shape. The river Thames became like an animated reptile, of ponderous growth, serpentining along, and seeming to encircle in its coils the mighty London, the mistress of the world. Crossing the river between the Tower and Blackwall, and surveying the scene we were passing from, the lights sprung up in rapid succession like glowworms in the twilight. The objects became more compact, and the bridges bore the semblance of beautiful and sparkling fillets, encircling here and there an immense boa-constrictor, and fettered, as it were, or controlled, by white and riband-looking roads, the inlets and outlets of the great city. Shortly after this we attained our highest altitude—six thousand two hundred feet, or nearly one mile and a quarter. We had expected, from what we had often heard, that some difficulty of respiration would have been experienced; but, so far from this, we fancied that it was more free than usual, added to a buoyany of feeling perfectly delicious; and, instead of the cold usually resulting from a great elevation and a rarefied atmosphere, the heat was unusually oppressive. We next passed over the forest of Epping. We now commenced rapidly to descend, till within two thousand three hundred feet of the earth, as indicated by the barometer. For the first time we became sensible of the motion of the balloon, our gradual approach to objects, enabled us, by comparison, to form a judgment of the swiftness of our course.

The most sublime object that accompanied us throughout our trip, when night had set in, was the moon and its effects on the scene beneath. The reflection of the moonbeams upon the river—now bursting upon the vision, now coquettishly disappearing—leaving this in darkness, and suddenly presenting the same appearance in a thousand different quarters—rescuing solitary scraps or sheets of water from obscurity, rather as if it were artificially produced, than the mere result of accident. As an artist, I was delighted with the light and shade of the scene; and one of the most prominent objects attracting our attention, from its uniqueness of character, was the moon's reflection on the ball, and the mighty shadow of the latter upon the earth. Although at the great elevation at which we then were, we were much surprised to find with what exceeding and clear distinctness we could hear the voices and distinguish the words of these who, attracted by the novelty of the object, were assembled beneath; the conversation, mundane and celestial, if not very *edifying*, was at least *highly* amusing.

Mr. Green now became anxious to descend—but finding, from information afforded by the good folks below, that the ground was not well adapted for his purpose, we rose considerably, but still in the same direction, until we found a fitter spot, as well as the obscurity enabled Mr. Green to judge, being without the guide-line. Our car company had been so exceedingly pleasant, that it was not without regret we heard of his intention to descend. Capt. Curry, who is a veteran aeronaut, this being his thirty-third ascent, delighted the company with the favourite ballad of "The jolly young waterman," with many other little flashes of amusement, which he called *sky*-larking. We had "nectar and ambrosia" in abundance. Now to the descent. Mr. Green's anxiety suspended all these pleasing pastimes—and, having arrived at a place that he thought would be suitable, he encountered a difficulty from the sudden springing up of a ground breeze. The grappling-iron was thrown out, but, from the nature of the surface, a hold could not be retained, until after two or three attempts, when, with the assistance of the country people, the iron was properly planted, and we owed especial thanks to sundry little urchins, who bounded over hedge and ditch to our assistance. We were sorry to find the balloon considerably injured from having been a short time entangled in the embraces of a solitary ash-tree. Our descent was, however, effected scatheless, barring sundry bumps and thumps, which however formed but a slight alloy to the pleasure of our trip. The gentlemen of the party then assisted us to alight, precisely at twenty minutes to nine, having been in the air

exactly an hour and ten minutes. We were now on *terra firma* at Knavestock, near Brentwood, in Essex, twenty-three miles from Vauxhall. We were kindly invited to the house of Mr. J. Crouchman, by his good lady, who was attracted to the ground; and to her kindness, and the efficient services of her husband, we were much indebted. Finding we were in a part of the country abounding in cross roads, and the cattle being engaged in the harvest, it was three hours before a conveyance for the balloon could be obtained. A very unpleasant incident occurred after landing, some one having abstracted the ornamental drapery of the car; but, through the vigilance of the police, a fine young fellow was presented to us manacled as the thief. Mr. Green had previously handsomely rewarded him, to share with his fellows. It was our own opinion that the poor fellow did not wish so much to take it for its value, as to obtain a relic.

Then comes the price of pleasure. There were Mrs. Green and myself, Dr. Locock, Captain Curry, Mr. Dally, a gentleman whose name we did not learn, and Mr. Green, driven to our wit's end. We called a council of expediency. We found ourselves six miles from any posthouse. The gentlemen were capable of walking six miles; this was, however, rather too great a distance for two ladies, and, by direction, we sought shelter at a house a mile and a half distant, where, we regret to say—through a female oracle, we suppose the landlady—admission was refused the party, benighted as we were; showing not only a want of common courtesy, but a complete lack of humanity, and more especially to those of her own sex. Baffled in this reason-

EAGLE AND RAVEN.

He clasps the crag with hooked hands,
Close to the sun in lonely lands;
Ring'd with the azure world he stands,
The wrinkled sea beneath him crawls;
He watches from his mountain walls,
And like a thunderbolt he falls.—TENNYSON.

able appeal, we retraced our steps to the hospitable cottage of Mr. Alexander Doddington, a few minutes' walk, whose whole family vied with each other in ministering to our wishes. One of his sons was immediately despatched on horseback to furnish us with such stores as he was himself deficient in. Our eventful career was finished in comfort before a blazing fire, lighted for our especial benefit, and every other accommodation was at our service. It is pleasing to contrast the warm-hearted kindness of this worthy family with the unfeeling brutality of the other. A postchaise was obtained shortly afterwards, and we reached town in the morning, between nine and ten o'clock, delighted with our excursion, nothing the worse for an adventure or two, and looking forward with much pleasure to our next trip to the Isle of "*Sky*." I have, &c.

JOANNA FORREST.

The newspapers in November, gave the following account of the widow of Montgolfier: — "This lady, who has now reached the very advanced age of 107 years, lately visited the town of Triel, in the Department of Seine et Oise, for the sake of seeing the fine bridge erected by her two grandsons, the MM. Seguin. She was accompanied by some of the first people of the town. She made the tour on foot, and seemingly with the greatest ease possible."

1842.—This year Mr. Wise made an ascent from Lewistown, Pa., in April; and another from Gettysburg, in September. He says:—

After rising to a considerable altitude symptoms of excited electricity were powerfully exhibited by the attractive force of the upper part of the balloon as it passed slowly through the eddy between the upper and lower currents of air. Rising above this point by a circuitous ascent, the country for many miles round became visible. The borough of Lewistown represented a figure like the letter Y. While still ascending, mountain after valley, and valley after mountain sprung up out of the body of the earth as by magic. The sublime workmanship of Him that made the heavens and the earth burst upon the vision with amazing grandeur, and smiling nature, clad in her vernal garb, looked up toward heaven with a pleasing countenance. For an hour or more new and beautiful scenes were continually developing themselves. The mountains appeared to range in astonishingly exact parallel semicircles, alternated by the gayer-coloured valleys between them.

The Juniata River, meandering through the mountains, added much to the beauty of the scene; and my attention was particularly drawn to that portion of the river which passes through the narrows just below Lewistown. The probability of the impression which has obtained with many persons, that the river has, by a sapping, percolating process, worked its way through the mountain, is entirely destroyed when the place is viewed from the point where I passed it. From there it has the appearance of an original formation coeval with the earth's adaptation to watercourses; and, were it otherwise, it might have worked its way through some distance above by a shorter and apparently easier route, or continued seven or eight miles further in the upper valley to where it blends with the one on the other side, into which the river runs.

A calm and deliberate contemplation of the workmanship of the earth, when viewed from a high, isolated position, bringing it in view as a whole, leads the mind to very different suppositions and conclusions to what it would arrive at when viewing it from its own surface. It may be properly illustrated by the comparison of looking at a rivulet, or the great river that rises from a number of them; or in viewing a single house, or the whole city. The earth, viewed from a great height, assumes a regularity of order, skill, and arrangement, which cannot fail to strike the mind of an observer with force and admiration.

In May following I made an ascension from Bellefonte, Pa. The last paragraph of the log-book of that voyage says: I have at present in use a black balloon, which creates a congenial atmosphere around itself in the cold upper regions of the air from the radiating superiority of that colour over a lighter one. It is now beyond a doubt in my mind established, *that a current from west to east in the atmosphere is constantly in motion* within the height of 12,000 feet above the ocean. Nearly all my trips are strong proofs of this.

While I was remaining at Wilkesbarre, a very flattering invitation from Messrs. Glossbrenner and Morris, of York, Pa., who were then on a visit to the Wyoming Valley, was tendered me to come to their borough and make an ascension, which I cheerfully accepted. The late Mr. Mills, a very successful aeronaut, had made a very satisfactory ascension from York the summer previous, and died there while making preparations for a second.

A Mr. Parker, who professed to be an aeronaut, volunteered to make the ascension which Mr. Mills had made preparations for, but he failed in getting up with the balloon; and shortly afterwards tried and failed again, which exasperated the populace to such a degree that it became necessary for Mr. Parker's safety to put him in the hands of the sheriff of the county. This double failure had a tendency to make the people of that county rather suspiciously inclined towards balloon experiments. Many of the country people believed it to be a plotting humbug in order to delude them into the town; others doubted the sincerity of balloonists' intentions of going up, looking at it as a dangerous business. These circumstances made it a delicate matter for me, in case I should be so unfortunate as to fail in getting up; and although I had now acquired a reputation as a "successful aeronaut," it only made it worse for me, in the event of any accident that might foil me in making the ascension according to announcement. The balloon which I had then in use was not throughout of strong material, being made of black silk, a part of which being of a different texture from the other, was very mellow. However, an ascension was determined on, let the consequences be what they would. The last Saturday in August, 1842, was appointed for the experiment; and as it was one fraught with interest on various accounts, a detailed description of it will be interesting.

As fate would have it, the day turned out with boisterous and stormy weather. The atmosphere was continually charged with black thunder-clouds, and incessant squalls of wind alternated the strong gale from the west which blew all day. The people, no way daunted from the last summer's failures, poured into town in a continuous stream. Twelve o'clock came, the time for commencing the inflation, but it brought no hopes of success in case it should be attempted. The people began to gather round the enclosed arena, which occupied a large open common on the outskirt of the town, and frequent and determined were the threats from their lips of what would be done in case they should be "humbugged again." As the time passed on, my friends also became uneasy, they thinking I was rather timid. Thus things went on until near two o'clock, the time announced for starting on the voyage, and things were coming to a crisis; already from eight to ten thousand persons had assembled on the common, and more than threat had already commenced to develop itself in some angry countenances. The last consolatory words from my particular friends were, "You are in danger of violence." I had remonstrated against their advice of going on, as I contended that a failure would be more fatal to all concerned than a postponement to a better day. But they told me a postponement was out of the question under the circumstances. Now, as I had no confidence in the strength of my balloon holding out under such squalls, and as a postponement would not be tolerated, I determined to reason with the people, and at once went to the outside of the arena, mounted a table, beckoned the immense crowd to listen to me for a minute, which, after one very refractory individual had been quieted, was granted.

I made a brief statement of facts and circumstances, as connected with the occasion, and mentioned to them that God made the weather, while I professed only to make ascensions, and then put the question to them whether I should go on under the circumstances, or postpone it to a better day, with the proviso, however, that they would buy tickets under the risk of a failure, and that they were *not* to mob me, nor suffer me to be mobbed, nor ask their money back if I should fail on account of the weather. It was unanimously agreed that I should go on, with a loud promise, "We will stand by you through thick and thin." Just at this moment a gentleman stepped up, who I learned was Doctor Ness, and in a proper and terse manner substantiated my explanations.

In another moment the gas retorts were in active operation, as no time was to be lost in getting the balloon inflated. This process had not gone on long before every one present began to realise the truth of my remarks.

The balloon stood the blast, and at four o'clock was sufficiently inflated to prepare her for the flight. As the inflation and start are sensibly and graphically described by the 'York Gazette,' its article relative to this occasion may be properly quoted:—"Mr. John Wise,' the celebrated American aeronaut, made from an enclosure at this place on Saturday last, one of the most beautiful balloon ascensions ever witnessed in Pennsylvania, or probably in the Union. An immense crowd was assembled to witness the ascension; the number is variously estimated at from six to ten thousand persons.

"There was quite a strong breeze early in the morning, and it continued to blow up to, and beyond the hour at which the inflation was to have commenced. This occasioned some delay, as it is exceedingly difficult to inflate a balloon in a strong wind, and in four cases out of five when it is attempted the balloon is torn during the process. At about two o'clock, though the wind had not entirely ceased, Mr. Wise, anxious to gratify the thousands who had assembled, many of them from a considerable distance, to witness an ascension, determined, at the risk of

destroying his new and costly balloon, to commence the inflation. Then the danger became evident to all; for although the wind was very slight, yet as soon as the balloon had been swelled by the gas to a height of six or eight feet, so as to present any surface to the wind, it became as fractious as a drunken Mohawk. Mr. Wise found it necessary to have the assistance of about a dozen of his friends, who were all kept quite busy in preventing it from tearing itself to pieces.

"The excellent preparatory arrangements, however, of Mr. Wise, and his unruffled temper and systematic method of conducting the process, overcame all the difficulties; and at about four o'clock he attached his car to its aerial steed, entered it as coolly as though about to seat himself for a ride upon an 'ambling pad pony,' and was launched, amid the cheers and shouts of congregated thousands, into the air.

"He cleared the enclosure by about ten feet, and sank a few feet immediately on the outside; but by throwing out a portion of his ballast he was enabled to rise sufficiently as he moved off beautifully in an easterly direction. He seemed, to those who saw him from the point at which he started, to rise as he receded, keeping on in one direction until lost to their view behind a cloud about five miles distant.

"We never saw a more gratified multitude than were assembled on this occasion. All seemed delighted, and to be at a loss for words to express their admiration of the sight presented by the daring aeronaut as he replied from his seemingly perilous height by a graceful wave of his hat to the cheers that continued to greet him as long as his features could be distinguished."

Narrative of the Journal:—

At fifteen minutes past four o'clock the aerial ship, United States, was released from her moorings under a heavy blow from the south-west, gliding swiftly near the surface of the earth until her ascending power was increased by a discharge of about forty pounds of ballast: when at a distance of several miles from the common the ascent became very rapid. At eight minutes after the start I passed through some filmy clouds, going nearly parallel with the railroad all the time, and in a few minutes overtook the locomotive, which had started about fifteen minutes before the balloon did. At 4.30 I commenced penetrating a dense stratum of clouds, after having enjoyed a magnificent view of the country for thirty miles round, bringing into view over fifty towns and villages, innumerable streams of water, with the beautiful Susquehanna in their midst. On entering the clouds the atmosphere grew cold; but after passing through the lower stratum, and getting into the shadow of cloud-patches far above the lower layer, the cold became so intense as to convert my breath freely into hoar-frost. I did not suffer much from this cold atmosphere, as the excitement of the day had supplied me with a fervour that lasted through the whole voyage; and it would be a senseless being indeed that could pass through such scenes without excitement. While passing through the clouds, the balloon rising at a furious rate, I attempted to open the valve to discharge gas, but was prevented by the lower part of the balloon having so closely taken the valve-rope into a fold, it being flaccid, that it became impossible to work the rope through. This would of course become relieved by the expansion of the gas, which would unfold it as it would rise into a rarer region of the atmosphere; but as the balloon was mounting so rapidly, and the air quite cold enough already, I was determined to arrest its upward progress by a violent tug of the valve-rope, which succeeded in releasing it, and bringing with it a strip of the balloon five feet long and seven inches wide at one end, tapering to a point at the other. This piece came clear out of the balloon and dropped down by the car, so near that I reached for it as it fell past. Being from the lower side of the balloon, it would cause no serious consequences, unless in case of a rapid descent it might by the rush of air against it cause it to slit upwards, and open the whole side of the balloon, an accident which would not endanger my life. After having risen some distance above the clouds into a clear sunshine the temperature became more congenial, and a most brilliant cloud-scene lay beneath me; a spacious, snow-white concavity, with here and there a pyramidical projection jutting from the common surface. To the south-east a violent ebullition in the cloud-ocean indicated the formation of a thunderstorm, which soon developed itself in uprising cloud-columns discharging electric flashes and *rattling* thunder. The shadow of the balloon was visible on the surface of the clouds below, and, after getting so high that it became completely distended, I discharged gas from the valve, while it was at the same time copiously discharging from the hole which had been made in tearing out the piece with the valve-rope. The gas escaping from the rent below assumed a white, milky colour. Looking down upon the clouds at this time a most beautiful phenomenon presented itself, like that on the disc of a camera-obscura. Around the dark shadow of the balloon there appeared a bright blue ring; and on the outside of this ring, surrounding it, there blazed out a brilliant halo of fiery red. This splendid image increased and diminished in

size as the balloon was lowered or elevated above the cloud-stratum. I gazed on it until my eyes became dazzled and painfully affected by its brilliancy, and I could not refrain from ejaculating over the transcendent privilege of viewing such celestial grandeur; for at this time a combination of scenes and circumstances, never before witnessed at one time, conspired to make the scene grand beyond the power of description.

When my aerial ship had passed over the thunderstorm, and got some distance ahead of it, I gradually descended, reaching the cloud-ocean in five or six minutes; and when in this cold, misty sea my feelings became painfully depressed; the transition from so beautiful a haven assisted in no small degree in producing the gloomy and morbid sensations that followed. I really felt like an expelled intruder, who had been driven from a usurpation. As soon as I got through this gloomy abode of the clouds, and in view of as beautiful a prospect as the eye ever gazed on, the fertile landscape of Lancaster county, my spirits became somewhat revived; besides, I was now viewing the place of my birth, the town, the street, the pleasure-grounds of my youthful days, dreams, enchantments, realities, doubts, all seemed to have held their sway within the last hour. Such voyages are strange and exciting things.

After sailing over the city of Lancaster my course was parallel with the Pennsylvania railroad, down which a locomotive was plying with a train of cars, which was soon overtaken and passed, showing that steam cannot compete with balloon speed, when they both move in the same direction. At thirteen minutes past five o'clock I landed on the farm of Wm. Hiester, Esq., near the village of Newholland, about thirty-nine miles from the starting-point, being at the rate of fifty miles per hour in the horizontal direction.

When I returned to York the citizens had already contributed an amount considerably over and above the sum demanded by me as an inducement to make a balloon ascension, for another balloon voyage from their place.

This ascension took place on the 20th of August following, on which occasion the day turned out to be of fine clear weather, and a very calm atmosphere. The 'York Gazette,' in noticing this voyage, indulges in the following remarks:—"We considered his thirty-sixth ascension the *ne plus ultra* in grandeur, but it was far exceeded by the last. Mr. Wise, on this occasion, was favoured by almost a perfect calm; and having cut his cord, he ascended almost perpendicularly to a height of four or five thousand feet. He receded from the spectators so slowly that they could distinguish his features for about three minutes, and his form five or six minutes, after his departure. In all this time he was receiving and gracefully acknowledging the reiterated and thundering peals of applause from delighted thousands. We never witnessed a crowd so completely carried away by their feeling of unmixed gratification. They did not seem to be able to find words commensurate with their enjoyment; but every moment shouts, spontaneous and simultaneous, would be sent up to the car of the aeronaut from countless throats, and the calm and collected occupant of the apparently frail vessel could be seen, with his head uncovered, returning the salutations as they reached him, from a height so tremendous that his form appeared to be reduced to the proportions only heard of in fairy tales.

"It is safe to predict, that not one of all the vast crowd assembled on Saturday will ever again witness on earth a spectacle so unutterably grand and sublime as that presented by Mr. Wise in leaving the earth on his thirty-seventh aerial voyage."

In lieu of the account from my log-book, the above has been quoted. The voyage being over nearly the same course as the one preceding it, and nothing of a new character having occurred in its progress, it would consist of a mere repetition of what has been said.

In September of 1842 I made an ascension from Gettysburg, Pennsylvania, of which the following account was written at the time. During the preparatory arrangements for my thirty-eighth aerial voyage, made from Gettysburg on the 10th inst., it was suggested by Professor Jacobs, of Pennsylvania College, in company with several other scientific gentlemen, to make some experiments upon the spiral ascent of the small balloons that were to be sent off as pilots. Having noticed that they revolved on their vertical axes when ascending, in a direction opposite to that of the revolutions of the hands of a clock lying with its face upwards, Professor Jacobs proposed that the remaining two pilots, should be started with a rotary motion, opposite to that which they assumed when let off uninfluenced. Accordingly, they were started with considerable impetus in that way; but that motion subsided in a very short time; and the other, or contrary motion, took effect, and continued as long as they could be seen, which was until they passed into the clouds. The large balloon also revolved in the same way on this occasion; and in pursuing these experiments, by throwing down when above the clouds substances of different kinds and shapes, they all felt with the same rotary motion. The atmosphere at the time of starting

on my voyage, twelve minutes before four o'clock, was perfectly calm, and the upper heaven was completely partitioned off from the earth by a thin layer of clouds. The height from the earth to the clouds was 3900 feet by measurement. The atmosphere became slightly colder as I ascended higher until entering the clouds, where it was somewhat warmer than just beneath them; and when entirely above them the sun's rays had a powerful effect upon my body and upon the balloon, as its accelerated upward motion quickly told.

The phenomenon of refracted light, which had so much interested me on a former voyage, made its appearance again upon the thin layer of clouds beneath, and my particular attention was now directed to its operation. The *parhelion* was this time more perfectly formed in regular prismatic rings, the cloud-stratum being thin on which it was refracted, and consequently did not reflect so much dazzling light as before, when it was thicker. It appeared too on this occasion that the cause assigned to its production on a former voyage was not altogether essential, being a profuse escape of gas, as on this it originated from the mere diffusion of gas round the balloon. The air being very calm, suffered the balloon to remain a longer time in the same spot, and consequently a rarer and more refractory medium would be formed around it, enhanced by the radiating power of its colour (black).

The shadow of the balloon was well defined on the clouds, and the prismatic colours forming rings around it were brilliant; there appeared also another, but dim shadow, immediately opposite the main one, much narrower and fainter; and they each crossed or rather laid on the prismatic rings, reaching from near the centre to some distance over the outer ring.

The smaller shadow was continually expanding and contracting, sometimes getting nearly as white as the main one, and then contracting into a mere line again, resembling in its action the *waving* motion of the aurora borealis. This motion I thought might have been caused by the different degrees of thickness of the cloud-stratum on which it was formed; as also the difference of distance between the balloon and the surface on which it acted, as the clouds were moving along, while the air-ship was apparently becalmed; this would continually change the condition of space between the object and its shadow, as it would the density of the substance that formed its screen. The parhelion and shadows varied in size as the balloon ascended or descended, which I caused it to do several times to a degree of not less than six to eight hundred feet. What appeared most remarkable to me was the appearance of this phenomenon after the balloon had descended between the clouds and the earth. While coming down over an open space in the clouds I noticed the parhelion disappear in it, and in another moment discovered it on the green surface below, being a wood, not with its regular rings, but in a red fiery halo, blending all the colours in it; and when it passed from the wood it was still perceptible on the green fields, but more diffuse than when on the wood. When I got below the cloud-stratum the balloon moved slowly in a horizontal direction, at the rate of about a mile in eight minutes; and whenever it would pass an opening in the clouds, so that it fell in the sun's rays, the fiery halo made its appearance at the corresponding point on the surface of the earth. The appearance of the phenomenon on the earth's surface was much like the reflected glare in the sky of a night during a conflagration.

During the early part of the voyage there appeared a magnificent sight in the west. No clouds being in that direction, at a point some miles off a portion of the mountain-region was receiving a flood of light from the sun, which gave it a peculiar lustre, such as I had never seen before, though it has often happened that the sun was shining only in spots upon the earth, which were visible to me. While in the clouds I noticed them to have a more milky-looking aspect than is usually the case; and it was noticed by the spectators below, who informed me of it afterwards; and they further remarked that "the balloon looked white" the moment of its submersion in the clouds, until it vanished from their sight. After I had been above the clouds for more than half an hour I came down once so low that the spectators from the town saw it for a moment; and they informed me that it was not far from the point where it had entered them at the start, making it evident that the balloon was almost totally becalmed while above the cloud-stratum. It was a peculiar state of the atmosphere throughout.

After remaining in the atmosphere eight minutes less than one hour, the greatest part of the time above the clouds, I came down to *terra firma*, two-and-a-half miles from the point where I had started.

These interesting facts were observed and noted with as much precision and deliberation as if they had been observed from my private chamber; and they were submitted to my friend, Professor Jacobs, who had been with me during the inflation, engaged in observing the experiments made before the start; and it was he that took the altitude of the clouds.

The people of Gettysburg were so much pleased and interested with this ascension that they determined to

have the experiment repeated in a few weeks afterwards. In the mean time, by their particular request, I entertained them with a public lecture on the subject of aeronautics, in the court-house. Touching strongly upon the simplicity of the science during this lecture, and portraying the magnificent grandeur of its developments to the practitioner of aeronautics, it inspired some of the hearers with an indescribable desire of its enjoyment; but only one of them was willing to believe implicitly what I had said of its *non*-danger, as practised by me. This individual was Colonel John M'Clellan, of Gettysburg. On the following day he made me a proposition to take him along with me on the contemplated voyage to be made in a few days from that place. The time being too short to make the extra arrangements necessary to carry another individual besides myself, I mentioned it to the Colonel, and at the same time informed him that if he did not wish to wait for another opportunity he might take my place on the Saturday following for half the price of what I had asked to take him with me, which would make it but fifty dollars instead of a hundred. He answered that he thought he would take me up at that. I did not believe, however, that he would go by himself, inasmuch as we had already spoken of making it suit to take him up at Emmetsburgh. When the day came for the ascension the Colonel made his appearance about half an hour before the time announced for starting; gave me the fifty dollars, security for the safe return of the balloon, and took some hasty instructions for the management of the machine while aloft, and also to effect a systematic descent. These were as promptly given him; and after this no persuasion, neither from his brothers and sisters nor from me, would induce him to relinquish his desire for the present; and so I sent him up, confident that he would come down safe if he did not give up the ship; and my last injunction to him was, "Stick to the ship." He went up in gallant style, throwing out ballast until he mounted to an altitude of about two miles, and then passed out of sight. He went about twenty-five miles, landing a few miles west of York, Pa., and was from thence escorted into York by some dozen acquaintances, who saw the balloon descending, and finding with it, to their great astonishment, Colonel John M'Clellan, of Gettysburg, instead of the individual with whom they had an understanding to meet, if he would come down near York. Indeed, I regretted that I had to forego the pleasure of paying my York friends a visit *viâ* the clouds, when I saw the favourableness of the breeze and the pertinacity of the Colonel's intentions.

When arrived at York, and surrounded by a host of friends, the Colonel was requested to give a detailed verbal description of his adventure, which he did, and with a great deal of accuracy, showing, that before he commenced coming down he had been a deliberate observer. Mr. Glossbrenner, editor of the 'York Gazette,' being present, took notes and made a publication of it in his next paper. It is written with some humour, but nevertheless with a graphicness and accuracy in regard to the appearance of things that could only come through the suggestions of an actual observer. This description has already become an historical fact, and is as follows:—

"Ballooning Extraordinary.

"A daring feat was accomplished on Saturday last by a citizen of our neighbouring town of Gettysburg. Mr. John Wise, *the* American aeronaut, *par excellence*, had announced his intention to make his thirty-ninth balloon ascension on that day, from an enclosure in Gettysburg, and, with his usual punctuality, was ready on the day and hour promised. His balloon was inflated; his ballast, grappling-iron, &c., duly stowed, and he was about to step into the basket. At that moment Mr. John M'Clellan, a young gentleman of Gettysburg, inquired of Mr. Wise whether it would not be possible for *two* persons to ascend with the power then in the balloon. On receiving a negative reply, Mr. M'Clellan seemed much disappointed; said he was determined to have a ride, and inquired the price at which Mr. Wise would permit him to make the voyage alone. 'One hundred dollars, sir,' said Mr. Wise, who did not appear to consider the inquirer to be in earnest. 'I will give you fifty dollars!' 'Agreed—fork over!' The joke was 'carried on,' and the *cream* of it was soon transferred to the pocket of the aeronaut, and his substitute was snugly seated in the car, vociferating his direction to 'cut loose!' Mr. Wise thought that matters had now gone far enough, and requested his customer to get out, as the time had arrived at which he had promised to be off. But he refused to do so, and insisted that he had regularly hired and paid for a passage 'in this boat,' and go he would. As Barney O'Reardon said to the man in the moon, when the latter respectable personage told him to 'lave his hould,'—'the more he bid him the more he wouldn't!'

"Mr. Wise then let up the balloon a short distance by a rope, thinking probably that as there was considerable wind, and the air-horse consequently turbulent, that his *substitute* would have his courage cooled, and 'give in;' but this was no go; and thinking that he had as good a start as ever he would have, Mr. M'Clellan cut the rope, *and was off!* After he found that it was the *determination* of Mr. M'Clellan to go, Mr. Wise had but time to give

him a few hasty and imperfect instructions in regard to the management of the balloon, and in a few minutes the daring amateur aeronaut had ascended to a height of about two miles. Here he struck a current of air which bore directly towards York. He says that the earth receded from him very rapidly after he had thrown a bag or two of sand upon it; that Gettysburg passed off towards Hagerstown, and that he saw Carlisle, Hanover, Abbottstown, Oxford, and Berlin strolling about; and that soon after, just ahead of him, he saw old York coming full tilt up the turnpike towards him, apparently taking an afternoon walk to Gettysburg. Having determined to stop at York, and fearing, from the remarkable speed at which our usually staid and sober town was travelling, that she would soon *pass under his balloon*, and give him the slip, he pulled the string attached to the safety-valve, in order to let off a portion of gas. This valve is so constructed that when a rope attached to it is pulled the valve opens to the interior, and again closes by the force of a spring when the rope is let go. Unfortunately, however, the inexperienced aeronaut pulled too violently at the valve-rope, tore the valve-door completely off its hinges, and brought it down into the car. When this occurred he was more than a mile high, and he immediately, and with fearful rapidity descended, or rather *fell*, to the earth. When the valve-door came off, the gas, of course, escaped rapidly, but the balloon caught sufficient air to form a parachute, by which the fall was moderated; and we are happy to say that the voyager reached the earth about five miles from York entirely uninjured. He says that as soon as the valve-door came down upon him he knew that something had 'broke loose;' and just then remembering that Mr. Wise had told him to be on his guard when he descended, and throw out his grappling-iron, he was preparing to get at it among the numerous things in the basket, 'when the earth *bounced up* against the bottom of the car!'

"When first seen from York, the balloon was about thirteen miles off, nearly due west. It appeared to be approaching directly toward our town, until the valve was pulled and it had fallen considerably. As it fell it seemed to find a current that bore it rapidly toward the north. The spot at which it landed is about north-west of our borough.

"The escape of the gas was distinctly seen from York; and as the balloon neared the earth it had lost its rotundity, and appeared to the gazers here to come down *heavily*, like a wet sheet."

This was another proof of the efficacy of atmospheric resistance in bringing large surfaces falling through it down with a moderate velocity.

1843.—This year is noted for the greatest attempt hitherto made to construct an Aerial Ship, of which Mr. Henson, a civil engineer, was the designer. It became so popular that, on the motion of Mr. Roebuck, the "Aerial Transit Bill" was read a first time in March. A trial, however, soon showed its defects. I leave its description to the Chapter "On the Method of Guiding Aerostats."

Mr. Phillips, also an engineer, published a circular, called "Aerodiphros," in which a company was proposed for carrying "aerial navigation" into practical effect. At the Royal Adelaide Gallery also was shown an ellipsoidal balloon, to be propelled by the Archimedean screw, designed by Monk Mason.

Mr. Wise's ascents in America are related by him as follows:—

The ascension from Carlisle was announced to come off the third Saturday in May, 1843. It turned out to be a very interesting one, as I had promised my friends in Lancaster city to visit them via the *atmospheric current that always blows from west to east* in the higher regions of the air.

Rev. Mr. Thorn, of Carlisle, a gentleman of the highest integrity, and well-trained scientific mind took a lively interest in the experiment, and is the author of the following eloquent description of the first balloon ascension made from that place:—

"The balloon ascension advertised by Mr. Wise, the celebrated aeronaut of forty aerostations, took place in this borough on Saturday last. The day was preceded by clouds and gusts of wind followed by rain, accompanied with the most vivid flashes of lightning and heaviest peals of thunder with which we have been visited for a length of a time; and indeed, so marked, according to human calculation, was the appearance of a continuance of

such weather, so subversive to successful exhibitions of this kind, that many persons imagined the feat would be abandoned or deferred. At about nine o'clock in the forenoon, however, the clouds began to disperse, and the sun, that bright orb of day, displayed his Creator's power, by dispelling the mists and density of the atmosphere in which we had been enveloped, and substituted in its stead the most clear and effulgent sky we ever beheld. At ten o'clock, hundreds of persons from various parts of the adjoining country, began to rush into our town, and to collect in various groups in our principal streets, which, together with the appearance and drill of Captain Washington's superior company of U.S. mounted Artillery with their cannon and accoutrements, gave an enlivening and imposing scene to our borough. Soon after twelve o'clock the process of inflation of the balloon was commenced; at two o'clock, preparatory arrangements were made by Mr. Wise for his ascent, which, in half an hour, were ready. Previous to it, however, he with great politeness came forward, and in a very respectful manner, gave an invitation to the ladies composing the assemblage within the enclosure to approach within the limits prescribed for them, that they might have a more clear and distinct view of the interesting scene they had convened to witness—which they accepted. He then proceeded to an interchange of salutations with the friends and acquaintances he observed around him—bade Mrs. Wise and his son, a promising lad of six years of age, an affectionate farewell; but with the entire confidence that the separation would be temporary—an absence of a few hours only. After which, making a general obeisance to all around, he stepped into what appeared to us a little brittle and insecure basket, with a fearless, unfaltering, and dignified mien. He then examined with composure the various articles which had been deposited therein, apparently with a view to adjust their balance, and to ascertain whether anything which might be required on his voyage had by any omission been left behind. Perceiving, to use a familiar phrase, 'that all was right,' and that the most intense interest was depicted on the countenance of every beholder, he gradually, but beautifully and majestically, ascended, amid the cheers, plaudits, and acclamations of the surrounding multitude, and the transporting strains of a fine band of music, discoursing an inspiring tune. Thus did the successful aerial navigator depart from the scenes of *terra firma*, to indulge from his cloud-skirt height in fancy's visions on the baseless fabrics 'of the world's ideal,' and of the skies unknown.

"The balloon arose, diverging but little from the direct line with which it set out; and the aeronaut continued several hundred yards above the spectators for a considerable time, waving his hat in recognition of the cheers which were complimenting him from below. The atmosphere calm and the sky serene, he remained in sight nearly an hour; some viewing him with telescopes, while he could no longer be seen with the naked eye. The following memorandum, being a description of the voyage, and written by Mr. Wise during his voyage, will doubtless be read with absorbing interest by every one. An incident related by him, relative to his descent at Lancaster, tends to increase the confidence that is already reposed in him as a scientific aeronaut, and of the management and direction he is capable of giving to his balloon. He had informed his friends and acquaintances at Lancaster that it was his intention to land there on this occasion, as it lay *east* from Carlisle—a direction, he says, he can always attain—and visit his domicile. The citizens, being thus apprised of his design, were awaiting his arrival, and when he came within a distance of being heard, they called aloud to him and said, 'Wise, you have redeemed your pledge!'

"Such being the favourable circumstances under which this experiment was made and ended, permit me to observe, that the remark is occasionally made in opposition to the science of aeronautics, that inventions of this kind are not to be encouraged or witnessed, because, through the perversion of men, they occasionally lead to vain and pernicious amusements. Admitting this to be the case, is this a reason why it should be decried and condemned any more than many other useful arts? But the objection usually, if not invariably, arises from persons of narrow minds and contracted views, relative to the progress of the human mind in the enlightening and renovation of mankind. Air balloons are destined ere long to be brought to such a state of perfection, and be made capable of raising and carrying so much weight, as to be applied to highly useful and important purposes. Let encouragement be given to these experiments; let 'the soul of fire, the invention ever new,' the 'lively cheer of vigour born,' and the incitement to continual exertion, both mental and bodily, by the emulation of ingenious men, be patronized sufficient to enable them to conduct their operations on an extensive scale, and time and experience will make them subservient to numerous philosophical uses, and bring to light many things which pass in the atmosphere; such as the formation of rain, of thunderstorms, of vapours, hail, snow, comets, meteors in general; and which, for the want of a method of ascending into it, cannot be known with precision.

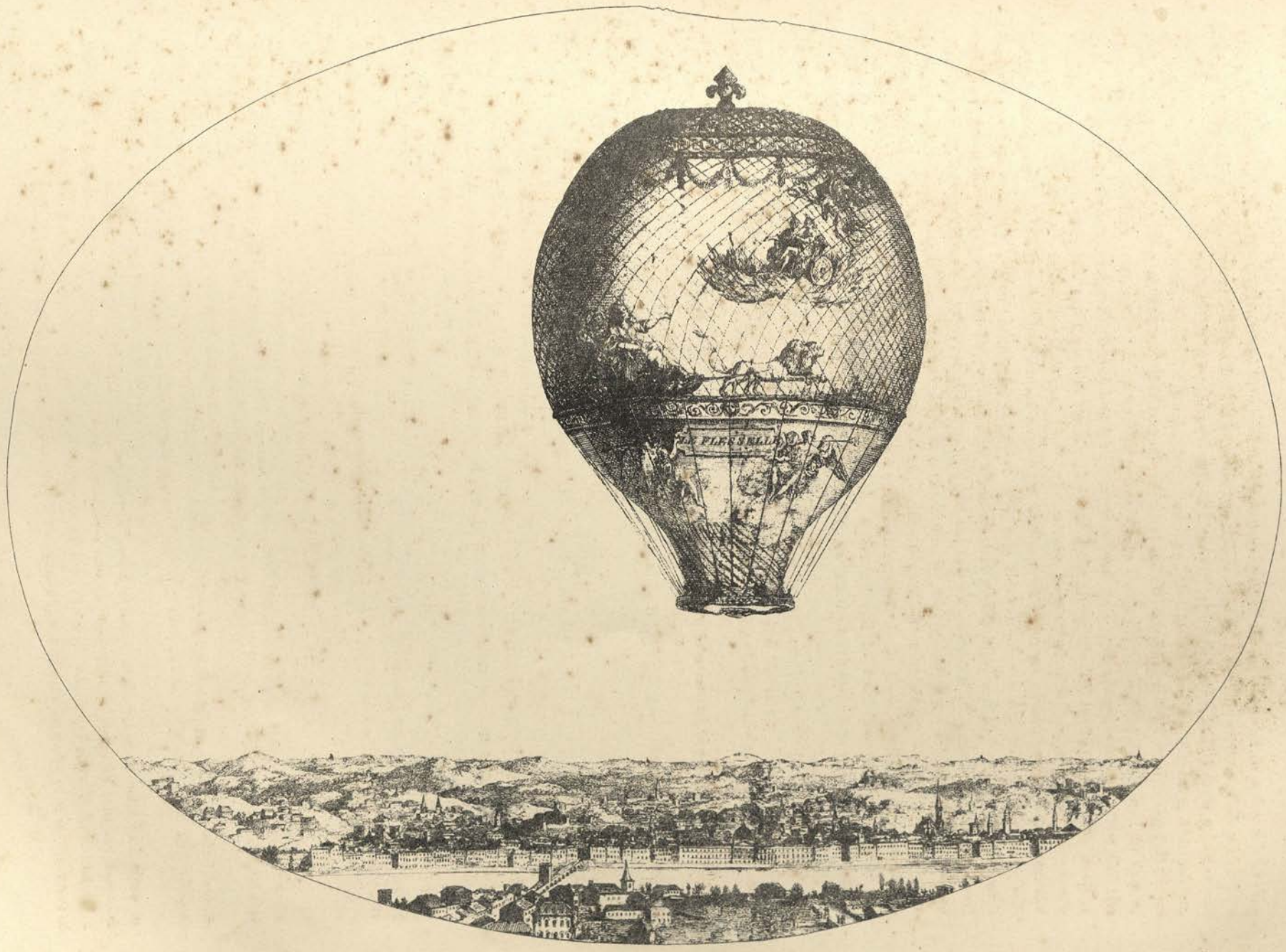


*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Holsham Jones R.E. Col.Sir H.James R.E. F.R.S.&c.Director.*

1864.

"They may tend also to the general improvement and amelioration of mankind, in effecting the designs of a beneficent Providence to a lost and ruined world. Is it not possible, nay, is it not probable, that ere long, if suitable inducements be held out to the promoters of this science, a contrivance or means of conducting expeditions through the atmosphere in a horizontal direction will be discovered, by making these machines subject to the helm of the aeronaut? And if so, may they not be converted to purposes of mercy; by exploring countries hitherto inaccessible; bringing together parts of the earth which are now estranged to each other, and spreading knowledge to all mankind? Many are the good and sensible men, who are of the opinion that every part of the habitable globe must yet be explored, and its inhabitants visited with the salvation of God. And who knows, but that by balloons this may be effected? Who will have the presumption to say that such a consummation will *never* be realized? And if *realized*, will it not present a literal fulfilment of 'Angels flying through the midst of the (aerial) heavens, having the everlasting gospel to preach to them that dwell upon the earth, and to every kindred and nation'?

"To these high and beneficent purposes we may add the gratification of curiosity and pleasure, as a very strong inducement to an encouragement to the practice of the art, in which, with any tolerable degree of caution and information, there appears very little of real danger. We have heard from Mr. Wise, and all who have tried the experiment testify to the same, that the beauty and grandeur of the prospect afforded by an aerial excursion cannot be exceeded, much less described. Nor do aeronauts ever experience the least of that giddiness consequent upon looking from great heights connected with the earth; nor have they any of that sickness arising from the motion of a vessel at sea. Many have been carried by balloons at the rate of thirty, forty, and fifty miles per hour, without feeling the least inconvenience or even agitation of the wind, for the reason that the machine moves with the wind and its velocity."

The following is an extract of the most important part of the journal kept on the occasion:—Left the earth at two o'clock thirty-five minutes; the lower current of wind from south-west moving moderately. At three o'clock, I passed on the south side of Mechanicsburg, at an altitude of about a mile, and still ascending. When at a considerable height above the clouds, another current blowing from north-west was encountered. This gave me an opportunity of making north or south latitude while pursuing my voyage eastward, as the occasion required, by sailing with one or the other of these currents. While nearing the Susquehanna River a magnificent view was opened; York, Carlisle, Harrisburg, and even Lancaster, were embraced in this grand panoramic view, with all its innumerable villages and variety of splendid scenery. Upon its beauty I will not attempt to descant; it must be witnessed to be appreciated. Although the Creator has allowed me to enjoy this sublime privilege, he has not endowed my humble capacity with language adequate to express its grandeur. In viewing this scene of earthly glory, I was forcibly struck with the idea, that we are not of near so much importance in the eyes of Deity as man presumes himself to be; and not more so to the Creator than the minutest animalcule is to man. And now, in reference to the puerile fanaticism of "Millerism," I would remark that the world, clothed in her verdant summer garb, looked so young and so beautiful, and so far from having the slightest appearance of decay, or an intention of committing suicide by elementary self-destruction, that she reminded me of a gay and blooming maiden just emerging from the days of her innocence into sober womanhood. If any of the deluded followers of Miller doubt this, let them go aloft of a fine summer's day, and view the earth, and if they then don't abandon their nonsensical views, nor feel ashamed of their narrow-minded conceptions of the goodness and greatness of the Creator, they must indeed be weak in the spirit as well as in the flesh.

[The Miller fanaticism was raging at that time in the neighbourhood.]

At three o'clock twenty minutes, I passed over a vast body of clouds, which reflected a powerful heat against the balloon, causing it to rise to a great height while in the field of reflected rays, and, therefore, obscuring from my view Harrisburg, and to the south, as far as York, the whole of the country. The current below, however, being nearly at right angles in its direction to that above, consequently, soon cleared the space beneath me. My course now lay down the west side of the river. Seeing the necessity of making more south latitude in order to reach my port, until a point was reached nearly over the mouth of Codorus Creek, I soon after descended into the lower current, coming from the south-west, by which I could reach a point near the city of Lancaster, which was now in full view. This took me over the town of Marietta a little after four o'clock, and almost in a direct line for Lancaster. At fifteen minutes before five o'clock I reached a point within a few hundred yards of the city bounds, where I came down. Seeing the people rushing out of the city, a-foot and a-horse, old and young, great and small,

rich and poor, intermingled with strains of music and the ringing of bells, I was soon encircled by my fellow-citizens of Lancaster, into whose custody I most cheerfully submitted myself, and will now let the balance of this interesting experiment be detailed by my old and esteemed friend, John W. Forney, Esq., of the 'Lancaster Intelligencer and Journal,' who was an eye-witness of the scene.

BEAUTIFUL AND INTERESTING SPECTACLE.

"About a quarter before four o'clock on Saturday last, a black speck, no bigger than a man's hand, was seen a little north-west of this city. Some pronounced it one of Miller's 'signs'—some declared it to be a new and unrecorded phenomenon—and while all were thus arguing as to its character the speck grew larger and larger, until, at last, the impression began to prevail that it was no less a personage than the great aeronaut, our townsman, *Wise*, who had started that afternoon from Carlisle, a distance of some fifty-four miles by railroad; and, with a precision equal to that of the recent discoverer of aerial navigation in England, he had *directed* his chariot with such admirable generalship through the regions of space, as to hang suspended, a little more than two hours after his departure from Carlisle, over his native city! The day was one in which all the clearness and moderation of May were combined, and the whole of the town had an opportunity to enjoy the rare and interesting sight. As the aeronaut gradually approached our ancient city—his balloon slowly increasing its dimensions—every man, woman, and child was out to watch its movements. At last, after having hung for nearly an hour in full view, he calmly and gracefully descended in his chariot of the clouds a short distance south-west of the city, where he was followed by crowds of horse and footmen.

"Supposing all to be over, the curious spectators retired; when, about five o'clock, the whole town was again astir to witness the aeronaut's triumphal entry into his native city. This was a singularly novel and interesting sight. Standing in the car of his balloon, the huge globe above still distended, almost touching the sides of the houses, and apparently eager for flight, he sailed through the streets at a slight elevation from the ground; his airy chariot drawn, or rather *guided*, by a number of young men and boys who had attached themselves to the rope which led from his car. In this way, with hat in had, and amid the cheers of his fellow-citizens, Mr. Wise passed through West King Street, and halted in Centre Square, immediately fronting North Queen Street. Here he was again greeted with the cheers of the people; but the sport was not yet over. After a rest of about fifteen minutes it soon became evident that Mr. Wise was about to attempt an ascension from Centre Square!—a rather contracted area, by the way, and too much walled in with houses, we should suppose, to make a balloon ascent either safe or pleasant. But Mr. *Wise* is not one of your holiday soldiers—his whole demeanour on Saturday proved him to be cool, collected, and intrepid, even to a fault. Having divested himself of nearly all his clothing but his pantaloons, even to his shoes, and detached the car from the balloon (the gas having been expended so much as to render the balloon incapable of carrying a heavy load), Mr. Wise took his seat on a narrow board attached to the cords of the balloon, and giving the signal to 'let go,' away he shot like an arrow from a well-strung bow, and nearly in a straight line, leaving behind him hundreds who were amazed at the singular boldness of the daring feat. He ascended, we should suppose, nearly a mile, and was fast fading from sight, when he began to descend, and actually alighted about two squares from the place of starting! This unparalleled performance was accomplished with great ease and rapidity, and proves Mr. Wise to be an able and experienced aeronaut."

After my Carlisle ascension I again appealed to my friends for their assistance to enable me to carry out the Transatlantic project, but got no further with them than a promise to promote my petition, which I had determined to lay before the next Congress. Believing that something would certainly come out of that, and always looking ahead in matters of this kind, I deemed it advisable to make a sort of a world's proclamation of the contemplated enterprise, which was done for the following reasons. Although I believed, and do still, that the *solar current* which I have invariably found above, blows clear around the earth, still a voyage across the Atlantic might subject the navigators to local currents and storms, and at best to all the omissions, imperfections, and unforeseen necessities attendant upon all first trials of this nature; consequently, there should be a general knowledge abroad, before the experiment would be made, so that in case of the balloon giving out from any cause while over the ocean, any ship at sea, being in sight of it, should come to its assistance.

I prepared the proclamation, and handed it to Mr. Forney, of the 'Lancaster Intelligencer,' who prefaced it with his own remarks; and a number of speculative commentaries were written by other persons concerning it as

it passed through the newspapers. Some of these will be related; and it will be observed how difficult it is, in looking at new projects, to separate the *ideal* from the *real* merits of the case. However, the proclamation has gone forth in the world, and the *substance* of it will follow, just as certain as steam followed horse-power.

AERIAL VOYAGE ACROSS THE OCEAN.

"The following announcement of Mr. Wise, the distinguished aeronaut, is one that cannot fail to excite public attention in a very great degree. Though the scheme may look somewhat Quixotic, we have no doubt Mr. Wise possesses the nerve to attempt, and, we believe, has the ability to carry it out. Our New York friends, therefore, must not be astonished to see our intelligent and scientific aeronaut arrive in their city next year with his 'large balloon,' and take his departure thence for the regions of the Old World. Would it not create a stir that would far exceed the reception of a hundred Presidents, though every man were a Tyler? And then what a sensation he would produce in England, as, coming along the Channel, he made preparations to settle down his aerial chariot in the heart of the great London World; or, missing this, suppose him dropping in upon the Frenchmen at Paris, or Calais, or Bordeaux; or, going further still, suppose him wafted into Constantinople, dashing down unceremoniously, and without notice, to the Sublime Porte! Why, our townsman would become more justly renowned than did Captain Ross in his voyage to the North Pale, or Lewis and Clarke in steering up the Mississippi, or the ambitious searcher after the still mysterious source of the Nile! [Not at all; for it is too easy a thing to accomplish.]

"Mr. Wise speaks for himself, however, in a tone of easy confidence that will surprise no one who knows his courage and resolution:"—

"J. W. FORNEY, Esq.—You will confer a favour to the enterprise in contemplation by giving the following proclamation publicity for general notice to the civilized world.

TO ALL PUBLISHERS OF NEWSPAPERS ON THE GLOBE.

"Lancaster, June, 1843.

"As it is my intention to make a trip across the Atlantic Ocean with a balloon, in the summer of 1844, and as the descent or landing of balloons, in my experience, has almost universally created unnecessary alarm and consternation to the people near by, I therefore give this general notice to the seafaring community of all climes, that should they, during any time henceforth, chance to be in the vicinity of a balloon, either on the ocean or in the atmosphere, they need not be under any fearful apprehensions, but endeavour to give aid to its adventurers.

"It must not be inferred from this that its success is considered improbable, but merely to be prepared for all emergencies.

"Having, from a long experience in aeronautics, been convinced that a constant and regular current of air is blowing at all times *from west to east with a velocity of from twenty to forty, and even sixty miles per hour*, according to its height from the earth; and having discovered a composition which renders silk or muslin impervious to hydrogen gas, so that a balloon may be kept afloat for many weeks, I feel confident, with these advantages, that a trip across the Atlantic will not be attended with as much real danger as by the common mode of transition.

"The balloon is to be one hundred feet in diameter, which will give it a net ascending power of twenty thousand pounds—being amply sufficient to make everything safe and comfortable. A seaworthy boat is to be used for the car, which is to be depended on in case the balloon should fail to accomplish the voyage. The boat is also calculated on in case the regular current of wind should be diverted from its course by the influence of the ocean, or through other causes. The crew to consist of three persons—viz., an aeronaut, a sea-navigator, and a scientific landsman.

"Therefore, the people of Europe, Africa, Asia, and all other parts, on the ocean or elsewhere, who have never seen a balloon, will bear in mind that it is a large globe made of cloth, ensconced in a network, with a sloop hanging underneath it, containing the latest news from the United States, and crew of the world's obedient servant."

This announcement was generally published throughout the Union, and throughout civilized Europe; and although its substance has not yet been accomplished, its postponement is attributable to a single cause—want of

pecuniary means to do it *right*. If Congress will *not* give the small appropriation necessary—ten or fifteen thousand dollars—to give it effect (I will not say to make an attempt, because its consummation is as certain as that a sail-ship can do it), our wealthy merchants of Philadelphia and New York cities should take it in hand, since it would enhance their facilities so much.

The following is another among the many commentaries that were elicited by the announcement, and, although it breathes a progressive and well-tempered spirit, it is nevertheless strongly tinctured with that inseparable sentiment so common to human nature, which undervalues projects that emanate from persons whom it is intimately acquainted with, and who have never *yet* accomplished great undertakings. However, the article contains so much good sound sense along with its humour and irony, that I will cheerfully bear the latter in consideration of the former, and publish it for what it is worth.

### Ballooning Extraordinary.

"That daring and (as the phrase goes) intrepid aeronaut, Mr. John Wise, of Lancaster, has issued a formal proclamation to the world, announcing that in the summer of 1844 he contemplates making a balloon voyage across the Atlantic, having from long experience in aeronautics become persuaded that such a mode of transition is not only feasible, but attended with fewer risks than those in ordinary use. He deems this timely notice due to the seafaring community, who, in looking aloft, may chance to descry him in the clouds, and who might otherwise be induced to class his 'coming' among the many mysterious 'signs and wonders' of the age.

"But, pray, why should not a trip across the Atlantic, in one of these silken cloud-coaches, be entirely practicable? To *us*, it is true, the project may look like the effervescence of a disordered intellect, and we may decry the undertaking as part and parcel of the impossible; but how many years is it since the man who first threatened to cross the ocean in a simple steam-carriage, with no *sails*, but a kettle filled with boiling water, was laughed at as a creature fit only for the friendly ministrations of the keeper of a mad-house? A shaved head and a strait-waistcoat were the promised rewards of the original projector of that most noble enterprise. And yet the foaming billows of the great deep are at this day hourly plied by the rushing steamship, bounding and puffing recklessly along, as though it were itself the victim of the madness ascribed to its projector; but landing, nevertheless, its precious freight unharmed upon the distant shores. Now, if such stupendous and astonishing results *have been* realised, what may not man, under the irresistible dominion of the great master-spirit of the age, *Progress*, what may he not accomplish? If the one event has been taken out of the narrow bounds which encircle the diminished catalogue of impossibilities, and has only, like the rising and setting of the sun, ceased to astonish because of its familiarity, why may not the exercise of human effort also consummate the other? And then, after Mr. Wise shall once have successfully pioneered the perilous pathway, and demonstrated that fewer lives are lost by travelling in balloons than by steam and canvass, why should it not ultimately become the universal means of locomotion? Why not, under the guidance of skilful and experienced air-navigators, also adapt balloons to the uses of commerce, as a means of import and export? If men, women, and children can be suspended for weeks over land and sea, in vessels of silk upheld by gas, and ultimately reach in safety their places of destination, why not also thus convey the chosen product of every land and clime? Why not *balloon* a load of cotton at Charleston, and in a few days receive the vessel 'bock agen,' freighted with British cloths or a cargo of teas from the 'Celestial Empire.' And then, too, such a 'reform' would spare to our trusty and well-beloved benefactor, Uncle Sam, the necessity of maintaining at such a heavy expense the *Navy*, there being no longer any use for ships and the like, although it might in turn almost subject him to the almost constant tricks of smugglers, owing to the uncertainty of the landing-places. If, therefore, we have not ourselves been all this time engaged in building 'air-castles,' Mr. Wise may yet be destined to *soar above* the fame of such common men as Robert Fulton and Oliver Evans."

Another writer says: "We publish below an announcement of the enterprising and intrepid aerial voyager, Mr. Wise, proclaiming his intention of crossing the Atlantic in a balloon! We are not prepared to express an opinion as to the feasibility of this project, but we do not doubt that Mr. W. is ready to attempt it."

Such were some of the numerous commentaries and opinions upon this contemplated expedition, which is *yet* to give the art an impulse that will waken it to its real merits. The following letter, received by due course of mail, post-marked "Newcastle, Delaware, June 28th," shows that there were not wanting proper persons necessary to fit out the expedition under skilful management:—

MR. WISE: Philadelphia, June 27th, 1843.

SIR,—Perceiving by the newspapers that you meditate an attempt to cross the Atlantic Ocean in a balloon next year, and that it is your intention to have with you a scientific person and a navigator, and as we heartily enter into the spirit of your enterprise, and at the same time place every confidence in your ability to complete the undertaking, we cheerfully offer you our services in the latter capacity (that is, as navigators).

If you should conclude on accepting of our company, we are in hopes you will inform us at as early a period as possible, so that we may signify our wishes to, and obtain the necessary permission from the Navy Department.

Very respectfully, your obedient servants,

ARCH. M'RAE,
SILAS BENT,
*Passed Midshipmen, U.S. Navy.*

On my return to Carlisle it was determined that I should be requested to repeat the experiment, as the first had only enhanced the desire for a second in those that witnessed it; and many people from the surrounding country who had not seen it were now very anxious for an opportunity of witnessing such an achievement. Consequently the 17th of June was appointed for the occasion.

One of the newspapers prefaced the narrative of this voyage in the following terms: "Our own thoughts were a good deal bent toward Bunker Hill on Saturday, but nevertheless we had on the same day in our own town a spectacle of an *elevated* character, and of a thrilling and exciting interest. As upon the former occasion, Mr. Wise's forty-first ascension with his balloon drew together an immense concourse of the 'beauty and chivalry' of Cumberland and Perry counties. It is not necessary to say more than that it went off with the greatest *éclat*, and seemed to have given the highest gratification to all who witnessed it.

"We are indebted to Mr. Wise for the narrative of his aerial voyage, which is subjoined. It will be seen that he encountered insuperable difficulties, and not a little danger, which brought him back to earth again after a trip of a few miles. Mr. Wise is to be congratulated on his safe and fortunate escape from the dangers of that 'long, low, black' cloud, which from his description one might judge to be the very dominions of the evil 'prince of the powers of the air.' The narrative possesses much interest."

### NARRATIVE.

According to announcement, I started on Saturday last on my forty-first aerial excursion, from the Centre Square of Carlisle, at precisely fifteen minutes past two o'clock in the afternoon, it being the 17th of June, 1843. A slight breeze from the west wafted me a short distance in its direction horizontally, after which the ascent became nearly perpendicular until the height attained was about 2500 feet, when the balloon moved off towards the east with a velocity much greater than that of its ascent. The first thing that drew my attention was the immense ocean of heads that was presented in the square below. There appeared to be infinitely more people on the immediate ground than was usually the case; and the whole scene was rendered highly animated and imposing by the fine appearance of the military, and their repeated salutes of thundering artillery at the departure of the "Comet." When I had reached a point about two miles east of the town, there appeared, a little distance beyond and above me, a huge black cloud. Seeing that the horizontal velocity of the balloon would carry it underneath and beyond the cloud, rising slowly as it did, and being desirous to gratify the spectators with the novelty of seeing a balloon pass through a cloud, preparations were at once made to effect it by throwing out some ballast as soon as its border should be reached. Harrisburg was now distinctly in view, and the balloon moving directly for it; I was hesitating, with the bag of ballast in my hand, whether I should throw it out for the purpose designed, or continue straight on as I was then going, to the place just mentioned. At this time I had reached a point underneath the cloud, which was expanding, and immediately felt an agitation in the machinery, and presently an upward tendency of the balloon, which also commenced to rotate rapidly on its vertical axis. I might now have discharged gas, and probably passed underneath it; but, thinking that it would soon be penetrated, and then might be passed above, as it appeared not to be moving along itself, I made no hesitation in letting the balloon go on its own way. This part of the feat, however, I had reason to regret soon afterwards; although at the present time it gives more real pleasure in contemplating its terrific grandeur and reality, than anything that has ever transpired in my aerial adventures. The details that shall here be given of this terrible scene may be relied on,

as I was sufficiently composed to appreciate its grandeur and observe its physical operations. The cloud, to the best of my judgment, covered an area of from four to six miles in diameter; it appeared of a circular form as I I entered it, considerably depressed in its lower surface, presenting a great concavity towards the earth; with its lower edges very ragged, and falling downwards with an agitated motion; and it was of a dark smoke colour. Just before entering this cloud, I noticed, at some distance off, a storm-cloud, from which there was apparently a heavy rain descending. The first sensations that I experienced when entering this cloud were extremely unpleasant. A suffocating sensation immediately ensued, which was shortly followed by a sickness at the stomach, arising from the gyrating, swinging motion of my car, causing me to vomit several times in quick succession most violently, which, however, soon abated and gave way to sensations that were truly calculated to neutralise more violent symptoms than a momentary squeamishness. The cold had now become intense, and everything around me of a fibrous nature became thickly covered with hoar frost—my whiskers jutting out with it far beyond my face, and the cords running up from my car looking like glass rods, these being glazed with ice and snow, and hail was indiscriminately pelting all around me. The cloud at this point, which I presumed to be about the midst of it from the terrible ebullition going on, had not that black appearance I observed on entering it, but was of a light milky colour, and so dense just at this time that I could hardly see the balloon, which was sixteen feet above the car. From the intensity of the cold in this cloud I supposed that the gas would rapidly condense, and the balloon consequently descend and take me out of it. In this, however, I was doomed to disappointment, for I soon found myself whirling upward with a fearful rapidity, the balloon gyrating, and the car describing a large circle in the cloud. A noise resembling the rushing of a thousand mill-dams, intermingled with a dismal moaning sound of wind, surrounded me in this terrible flight. Whether this noise was occasioned by the hail and snow which were so fearfully pelting the balloon, I am unable to tell, as the moaning sound must evidently have had another source. I was in hopes, when being hurled rapidly upward, that I should escape from the top of the cloud; but, as in the former expectations of an opposite release from this terrible place, disappointment was again my lot, and the congenial sunshine invariably above, which had already been anticipated by its faint glimmer through the top of the clouds, soon vanished with a violent downward surge of the balloon, as it appeared to me, of some hundred feet. This only subsided to be hurled upward again, when, having attained its maximum, it would again sink down with a swinging and fearful velocity, to be carried up again and let fall, which happened eight or ten times—all this time the storm raging with unabated fury, while the discharge of ballast would not let me out at the top of the cloud, nor the discharge of gas out of the bottom of it, though I had expended at least thirty pounds of the former in the first attempt, and not less than a thousand cubic feet of the latter; for the balloon had also become perforated with holes by the icicles that were formed where the melted snow ran on the cords at the point where they diverged from the balloon, and would, by the surging and swinging motion, pierce it through.

I experienced all this time an almost irresistible inclination to sleep, notwithstanding a nauseating feeling of the stomach, causing me to vomit several times, and the terrible predicament I was placed in, until after eating some snow and hail mixed, of which a considerable quantity had lodged on some canvass and paper lying in the bottom of the car. After this I felt somewhat easier in mind and in body (for it is no use to say that I cannot be agitated and alarmed), and I grasped a firm hold of the sides of the car, determined to abide the result with as much composure and observation as the nature of the case would admit; for I felt satisfied it could not last much longer, seeing that the balloon had become very much weakened by a great loss of gas. Once I saw the earth through a chasm in the cloud, but was hurled up once more after that, when, to my great joy, I fell clear out of it, after having been belched up and swallowed down repeatedly by this huge and terrific monster of the air, for a space of twenty minutes, which seemed like an age, for I thought my watch had been stopped while in it, till a comparison of it with another afterward proved the contrary. I landed in the midst of a pouring rain, on the farm of Mr. Goodyear, five miles from Carlisle, in a fallow-field, where the dashing rain bespattered me with mud from head to foot, as I stood in my car looking up at the fearful element which had just disgorged me.

The density of this cloud did not appear alike all through it, as I could at times see the balloon very distinctly above me, also, occasionally, pieces of paper, and whole newspapers, of which a considerable quantity were blown out of my car. I also noticed a violent convolutionary motion or action of the vapour of the cloud going on, and a promiscuous scattering of the hail and snow, as though it were projected from every point of the compass.

Such is the history of this short but magnificent trip; and I can assure my readers, that when I again meet

clouds of this character (which I shall name the "cloud of terror"), I will endeavour with all my skill to avoid them.

After this account had been published, and found its way into the newspapers, I received the following letter from Professor Espy, at Washington City, which was promptly answered :—

"DEAR SIR, "Washington City, July 5th, 1843.

"I was much interested with the account you gave in the public papers of your balloon ascension, on the 17th of last month, from Carlisle.

"You will confer a great favour on me if you will answer the following questions: Was there any rain or hail at the surface of the earth under the cloud which you entered? Did you descend through the base or lower part of the cloud, or did you get out of the cloud and descend in the clear air? Was the cloud into which you ascended surrounded by clear sky, or was the whole sky covered with clouds? Have you any reason to think there was an upmoving current of air going up into the base of the cloud, and continuing in the cloud itself, or did the velocity of your upward motion merely correspond with the buoyant power of the balloon? What was the cause of your ascending and descending eight or ten times, and how did you judge that this ascending and descending really occurred? Had you a barometer? Do you suppose the cloud was colder than it was on the outside of the cloud at the same height? Or not so cold? Are you sure your balloon was torn by the hail? Or might not you have ascended much higher by a very rapid motion than you supposed, and your gas have escaped by expansion through the bottom of the balloon?

"If there was a strong current of air under the cloud and in the cloud upwards, might you not in the time have gone so high as to diminish the pressure on your body so rapidly that part of the noise which you heard was the ringing of your ears? And might not the sickness have been from the same cause?

"If you find time to answer any of these questions, I shall be much obliged to you.

"Yours, very respectfully,

"JAMES P. ESPY."

When Congress had assembled at Washington, the following petition was submitted to their consideration; and when we take in view the small amount (15,000 dollars) it would have taken to prepare the experimental outfit, backed as it was by competent authority, it seems little encouragement is to be expected from that quarter, in any new enterprise, no matter how plausible, unless it carries with it some partisan force and object, calculated to promote aspiring and factious individual interests in some political fortune.

TO THE CONGRESS OF THE UNITED STATES.

*To the Honourable the Senate and House of Representatives of the United States of America in Congress assembled:—*

The petition of the subscriber, citizen of Lancaster, Pa., most respectfully showeth, that, from an experience of a number of years in the practice of aeronautics by the subscriber, it has been fully demonstrated that there exists in the atmosphere a constant current of wind, moving from west to east, with a velocity of from twenty, forty, and even sixty miles per hour, according to its height from the earth.

This current is moving in that direction, while the local currents may be, and are, moving in various other directions. This *eastward* current is governed by a great general cause, blowing at all times, making it feasible to travel the globe in that direction by aerial machinery with great facility.

Your petitioner would further state that the art of making aeronautic machines has been so far improved that they may be kept afloat for any reasonable length of time, even for years, and as long as a ship can be made to endure the sea for common purposes.

The main object of your petitioner is, to bring into useful requisition, for the purposes of speedy and safe transition of persons and merchandise, that great natural and unoccupied element, the atmosphere.

Your petitioner does not pretend to have discovered or solved any great, newfangled problem; but would most earnestly press upon your consideration known facts, which must be explored before any great benefits can be derived therefrom.

From the improved state to which aeronautic machinery can be perfected, and the advantages continually at hand from the local currents of air, it is even now feasible to travel eastward with a velocity that will circumnavigate the globe in from thirty to forty days, with an ability to vary from a straight course thirty or forty

degrees from the latitude of departure, which would enable us to leave despatches in Europe and China, and return by way of Oregon Territory to Washington City.

This has been demonstrated by experiments made by your petitioner, in reaching points sixty and ninety miles distant from the place of departure, with a precision not surpassed by ship-sailing, aided by the local currents in varying from the great eastward current.

From these considerations, your petitioner is induced to ask your honourable bodies to make a naval appropriation to carry this project into practical operation; its practicability having already received the confidence of scientific men, and an earnest and voluntary offer by several officers of our navy to accompany the first experimental adventure.

Your petitioner, therefore, prays you to make an appropriation for an outfit to this effect, viz.: The construction of an aerostat of 100 feet in diameter, of substantial domestic cotton drilling; a sea-boat capable of enduring the ocean, for a car, and so constructed that the masts and rigging may be stowed away, ready for erection into sea-service at any time that emergency *might* require. The sea-boat to be of 10,000 or 12,000 pounds weight; an aerostat of 100 feet diameter, having an ascending power of over 25,000, which will be sufficient to carry the outfit and crew.

Should this meet with your Congressional approbation, your petitioner will readily submit a plan in detail, and will cheerfully superintend the construction of the machinery at his own expense, asking nothing more than the command or directorship of the first experimental aerial voyage round the globe.

The whole cost of the experiment will not be more than a fraction of that of the late "Exploring Expedition;" and promises, at least, greater results.

For a favourable decision of your honourable bodies, your petitioner feels in duty bound to pray.

*Lancaster City, Dec.* 20, 1843. JOHN WISE.

This petition was received, read, and referred to the Committee of Naval Affairs, where it sleeps, soon to be awakened up again by the unconquerable force of human destiny.

1844.—Depuis Delcourt, an editor of a Parisian journal, having made his first ascent in 1824, zealously pursued his experiments till 1850, when he published the best history of the subject that has yet been written. He proposed to attempt an experiment this year with a large copper balloon, but never got beyond its construction. The necessary calculations were, I think, made by Mons. Marey Monge. This year also saw the first ascent of Mr. Coxwell, under the name of "Mr. Wells," to prevent anxiety among his relatives. He is the son of the late Captain Coxwell, R.N., and was born near Rochester, 2nd March, 1819; received his elementary education at Chatham, and was intended for the army; but, being disappointed of his commission, at the desire of his mother he became a surgeon-dentist. Finding his attention strongly attracted to aerostation, he thenceforth gave his whole mind to the subject.

The 'Register' newspaper of Hollidaysburg, Pa., thus records an ascent by the indefatigable American aeronaut, Mr. Wise, in May of this year:—

"The ascension of Mr. Wise, in his new and beautiful balloon 'Vesperus,' took place on Saturday last according to notice given. The day was entirely too stormy for an undertaking of the kind, and, in the opinion of every reasonable man, would have justified Mr. Wise in postponing the adventure; but, trusting in the excellence of his vessel and his skill as an aeronaut, he determined to make good his appointment and to satisfy every individual of his numerous audience. He accordingly, after a most laborious and oftentimes discouraging effort, succeeded in sufficiently inflating his balloon, and getting ready for the voyage, and at the hour appointed cut loose.

"The ascent, although evidently hazardous, from the rupture in the network by which he was attached to the balloon, and from the unsteady and squally state of the atmosphere, was sublime beyond description. When the cord was cut, he rose slowly from the arena, barely clearing the top of the enclosure, and taking a northern

direction he swept across the town, just escaping the house-tops; but, discharging a couple of sacks of ballast, he soon mounted high into the aerial regions to mingle with, as we supposed, the less angry elements above. But in this we were mistaken; for, long before the 'Vesperus' was out of sight, she was observed to be rocking strangely, as if the elements were no more friendly with her in her elevated position than when bound to earth. The account subjoined, by Mr. Wise, gives a full history of this part of the adventure.

"The ascent of a balloon is a spectacle that to be realised must be witnessed. No description can convey a just idea of its sublimity and beauty, as, like some creature of life, it smoothly and silently, and steadily mounts upwards, with its golden sides glittering in the rays of the sun, and its tiny basket and well-arranged cordage swinging gracefully beneath. And then as the intrepid aeronaut waves his hat at a fearful altitude and sends down a faint response to the loud huzzas below, and every breast heaves deeply with the conflicting emotions of admiration, fear, sympathy, and desire for like adventure, a thrill runs through the soul that no description can produce, however true and vivid.

"We need only add here, as the evidence will be given again, that Mr. Wise's conduct on the occasion was highly satisfactory to all concerned, and must greatly increase his reputation as an aeronaut; for we venture to say no other individual ever attempted an ascension under like unfavourable circumstances.

"At about eight o'clock in the evening we heard of his return, and, repairing to the U. S. Hotel, we found Mr. Wise, somewhat disheartened about the loss of his balloon, and looking rather worse for the trip—his outer man having suffered considerably from his adventure among the branches of the tree on which he lodged."

### Mr. Wise's Narrative.

The process of inflation was commenced at eleven o'clock A.M., under very disparaging circumstances, as the elements had combined from all points of the compass to a general and boisterous storm. Nothing, in short, but the most indefatigable energy and perseverance on the part of Mr. Downy and Mr. Woods, who had taken a most important charge under their hands, that of keeping the "Vesperus" to her place, could have enabled me to have made an ascension under such a war of the elements. During the process of inflation in the beginning, the reaction of the gas from the balloon, caused by a sudden flaw of wind, blew off the gasometer, which was soon replaced by my energetic friend Mr. Hinkle, and the inflation resumed, but under so much violence of the apparently frantic gamboling of the "Vesperus," surging to and fro the persons who were holding on to it, that I began to fear of their ability to endure the rough usage they were labouring under all the time, sometimes being partly raised up and then dashed to the ground, as by a maddened steed. However, after getting the assurance of those gentlemen that they would hold on, to use their own words, "to the last ribbon," I retained my confidence in accomplishing the ascension, until I received the heart-sickening information from my friends that the network was fast giving way about the top of the balloon. I now began to give up hopes of getting up, and even feared that the balloon would break through her trammels and escape; but Providence sent a gleam of sunshine, with a short abatement of the storm, during which time a good supply of gas was worked into the "Vesperus," sufficient for a long voyage.

At precisely three minutes past two o'clock, I mounted the car, and having ballasted the vessel while it was restrained by a cord, feeling, as I supposed, the rupture in the network increasing at every surge, which by this time had got so large, that a bulb as big as a hogshead was protruding through it, my preparations were speedily completed. Knowing now that time was precious, I cut the rope and gave my friends below a parting salute, which was heartily responded to by a thousand voices.

When afloat, I began to congratulate myself upon the victory that was gained over such formidable obstacles below, and felt a composure that the network would stand it safely now, as the balloon was free in the air. She took a northerly direction, ascending rapidly all the while, until an altitude of about a mile was attained, where a violent gale was encountered which made the balloon surge off in an easterly direction, swinging the car to and fro, and making the network crack at every surge, which alarmed me about my personal safety. Looking over the edge of my car at the immense depth to the surface of the earth, my heart began to sicken at the idea of falling that immense distance with nothing but the network and car to rely on; and my sensations were rendered still more gloomy by the lowering appearance of the heavens in every direction, as around and beneath the clouds could be seen discharging torrents of rain and wind, with, as I supposed, the moral certainty of the balloon's

escaping from the network in a very few more surges. I could see the valleys west of the Alleghany Mountain, on which the sun was shedding its beams of light and life.

I looked up at the balloon, and it appeared to me that the car was receding from it gradually, by the giving way of the network, and at this crisis an expedient flashed across my mind—the valve-rope would bear the weight of a hundred pounds, and the top of the balloon was equally strong—my weight was thrown upon it at once. This necessarily opened the valve to its full extent, and must soon bring the machine down to the ground. The velocity of the wind was about fifty or sixty miles per hour, and, between this and a rapid descent, *terra firma* was reached about sixteen miles east of Hollidaysburg. As soon as practicable an anchor was thrown out, which grappled in a fence and capsized it, when the machine bounded across the field, where it caught in the next fence, but broke it, carrying with it a fence-rail, causing the car to bound and rebound from the earth and dashing headlong into a very rugged piece of mountain woodland. At this juncture I clasped several of the net cords in my one arm and made a spring overboard for a fence that was intercepting my path, and unfortunately for me, at the same time the rail was loosened from the anchor, when the balloon rose with a sudden bound—my body outside of the car—one foot fast in the rigging, and my arm clasping several of the net cords. My right hand was still free, with which I quickly grasped the valve-rope which had been tied to the rim of the car, and secured it in my teeth, holding the valve open, when in another moment I found myself dashed into the top of a high tree, where I quickly grasped the limbs, still clasping the cords in my left arm. This brought the balloon to for a moment, when with my right hand a hitch round one of the limbs was taken with the anchor-rope. This was followed by a squall of wind which warned me to release my arm-hold of the cords, one foot still in the car, when, to my utmost dismay, I found my foot tangled in the rigging. There I was, holding on to the top of the tree with a death grip—head down and feet up, the balloon surging and drawing the top of the tree which I was holding to in the direction of the squall, only abating momentarily for a more violent surge; and I could no longer keep the valve open with my teeth, the rope had become too long, and I could not take a shorter hold, in the dilemma, without incurring another risk—that of letting one hand loose from the tree-top; but things were growing desperate, and I made a violent but successful effort to loose my foot, at the same time grasped the valve-rope in my hand, and in another moment a terrible crash indicated the balloon was off—having broken the anchor-rope, and jerked through my hand the valve-cord, burning it as though a hot wire had passed through it, and I left hanging in the top forks of the tree where I had fallen.

As soon as I had recovered a reasoning position, I looked upward and just saw the balloon dashing furiously off and upward into a dense black cloud, some distance to the north-east. In referring to my machinery, I found that I had taken unnecessary alarm; the cracking noise of the network must have arisen from the surging motion of the balloon, for the network had gone through double the force since landing, and not torn off yet, proving that it was all-sufficient to have borne its load to its destination; which greatly enhanced my chagrin, since the wind and weather were so favourable to have reached Philadelphia before dark. I began to reproach myself with unnecessary fear, until I saw my hat, map, newspapers, canvass, handkerchief, &c., scattered about below, when I began to think it might have been worse, though I should never see the "Vesperus" again.

After soliloquizing in the tree-top a while upon the day's adventure, I thought it time to come down, for I was near a hundred feet from the ground, leaving part of the anchor-rope dangling in its top, as a port of entry for the next aerial traveller who may chance to land there.

Within a few weeks afterwards I learned that the "Vesperus" had landed, the same day of her departure from Hollidaysburgh, at half-past six o'clock, on Mr. Van Valkenburg's field in the Catskill Mountains in the State of New York. I repaired thither and recovered the balloon. The persons in the neighbourhood were much astonished at its arrival, and it was under considerable apprehension they were induced to examine it. Mr. Van Valkenburg's son was out in the field ploughing round the hemlock-stumps when the balloon was coming down, and upon seeing it in the air thought it was an immense bird of prey pouncing down upon him, which alarmed him to such a degree that after he had fled to the house he was affected with violent spasms.—The balloon was suffered to roll and toss about the hemlock-stumps for some time before it was secured. The next wonder to the persons that secured it was, the newspapers that had remained in the car, they bearing the date of the day on which they found it, and Hollidaysburg was a place they knew nothing of, until they looked over their geographies; and then its being several hundred miles off over the mountains and rivers, puzzled them still more. The balloon was cut in six sections when I got it, Mr. Van Valkenburg informing me that an individual who had come along that way,

and who professed to be well informed in such matters, cut it up in that manner for them. The shrubbery which had been twined around the car before it started, had turned entirely black, showing that it had been in a high frosty atmosphere. The balloon had no doubt burst from the expansion of the gas, which caused it to come down so soon.

Before I took it away, all these wonderments of the people were explained to them, and they expressed a great desire to have an exhibition of such a novel kind in their neighbourhood. This machine was fixed up again, and after making a number of trips with it, two from the city of Columbia in South Carolina, I sold it to a gentleman of that State.

1845.—Mr. Coxwell having now come forward publicly, turned the energies of his mind to this science, and, with characteristic industry, started 'The Balloon or Aerostatic Magazine,' to elicit opinions and suggestions from any one, as well as to communicate his own. His undertaking met with the approbation and encouragement of the press, and his journal appeared occasionally till 1859.

In an ascent this year Mr. Charles Green's father, a gentleman eighty-three years of age, was one of the party.

1846.—Mr. Green made his second proposal to cross the Atlantic. The following are the notes of an ascent from Mr. Wise's log-book in this year:—

AERIAL LOG-BOOK OF FIFTY-FOURTH ATMOSPHERIC VOYAGE. BALLOON "ROUGH AND READY."

West Chester, Pa., August 8th, 1846.

Four o'clock fifteen minutes, started with a southerly breeze, at the rate of twenty-five miles per hour.

Four o'clock twenty minutes, atmosphere to the south and east perfectly clear. Can see Philadelphia as distinctly now as it has been seen at other times when not more than three miles off. The rain in that direction has cleared the atmosphere. See some sails on the Delaware—sun shining against them gives them a golden hue—vessels as distinct to my view as though I were on the river bank. Four o'clock thirty-five minutes, rumbling thunder to the far north. Four o'clock forty-five minutes, crossed Pennsylvania railroad.

[It may be here observed that the balloon was sailing towards the north-east, and a thundergust was moving from the north-west, about fifty or sixty miles to the north-west of me—thus moving at right angles with each other, and the remarkable result of the balloon meeting the storm at the point of intersection.]

Five o'clock, lost sight of West Chester. Came down now within good speaking distance of the earth, and so low that the Delaware vanished from view. Thunder pealing louder now, but no lightning perceptible. Talking to the people below as I passed along. Dogs barking at the balloon, and poultry dismayed in the barn-yards, keeping an alarming clatter. Distributing newspapers to persons below, who run and pick them up. Balloon moving rapidly. A man on horseback in hot pursuit. "Come on, come on, I'll give you the latest news from West Chester." Several papers were dropped now. There, he grasps at one from his horse. "Have you got it?" "*Yes, sir*," "Good-bye, sir," said I. "*Come down*," says he.

Five o'clock ten minutes, crossed Schuylkill above Norristown—threw out ballast and ascended very high. Can see all around to a great distance. Phœnixville, a little up the river. Going too much east to reach Reading. Come down again to within good speaking distance of the earth.

Five o'clock twenty minutes, near the Trappe, and over the Reading and Philadelphia pike. Invitations from all around me to "come down;" threw over some newspapers to the people—inquired if I could get supper there. "Yes, anything you want." To cap the climax, one of them sang out—"*Come down, and I will give you a bottle of brandy.*" "Thank you, sir; *spirited* enough; I believe I'll go a little further."

Five o'clock thirty-five minutes, thundergust approaching the track of the balloon. Low enough to hear the wind rustling in the trees. A great many persons following the balloon. Some give up the chase; others strike in with fresh vigour.

Five o'clock forty-five minutes, moving parallel with the Norristown and Sumanytown road. Storm and balloon converging to the same point—vivid flashes of lightning were now occasionally to be seen in the north.

Five o'clock fifty-five minutes, a man on a black horse in hot pursuit up the road—horse's head and tail in a straight line. The race is beautiful and exciting. He is losing ground every jump. Now he holds up a mile behind.

Six o'clock, and moving over a thick wood. Here I ceased taking notes—the car was near the tree-tops—thick woods underneath, and a roaring thunderstorm just ahead. Already its commotion was acting on the balloon, and it would not do to seek shelter among the trees below, and yet the alternative was to do that or sail right into the teeth of the storm, for there was not ballast enough left to *ensure* an ascent above it before getting into its midst. Indeed, it required all my ballast to keep above the tree-tops until the woods were passed, and this brought me right into the thundergust. A number of persons were following me from the woods afoot, but they could not keep pace with the balloon, falling back three-quarters in the mile. As soon as a clear spot was attained the anchor was thrown out, and the moment it struck the ground a vivid flash of lightning hurled the balloon against a tall oak-tree. What appeared to me remarkable in this was the absence of a report, but the fire flashed from my car and flag, the latter hurled out of the basket where it had been stuck in the wicker-work. This flash reminded me of the sparks that fly off from a piece of white-hot iron just taken from the forge on the anvil, and struck with the blacksmith's hammer; and the noise was very similar to that also. Just at this moment a young man was running to my assistance, intending to catch hold of a drag-rope which I had thrown out and requested him to take and make a hitch to a tree with, of which there were plenty around. But the flash brought him up suddenly, and made him stand aghast, and immediately retire. The balloon was now tangled in the oak-tree, and the smoke I had observed at the time of the flash, which, with the sulphurous smell, had alarmed me, was the gas issuing from the breaks it received against the scraggy branches of the tree. Fortunate it was, that there was no escape of gas at the time of the electrical flash, or an explosion might, and would, in all probability, have been the result.

The persons who had followed me from the woods, now came up, and before we could roll up the balloon, the gas having escaped readily from the breaches in it, we were enveloped in a terrible storm of thunder, lightning, and pouring rain.

When I returned to West Chester, arrangements were made for another ascension from that place, on the 24th of the same month, but nothing of importance was elicited in its adventure.

In the beginning of the following September I made an ascension from the city of Utica, in the State of New York, having received an invitation from there. It was the first ascension ever made from Utica. The 'Daily Gazette' of that place spoke of it in the following terms: "All who witnessed this ascension, agree to its being one of the most beautiful, interesting, and sublime sights that can be seen. Its peculiar attractiveness, however, cannot be described. There is something in the rise of any inanimate body in the air, that always singularly interests us; witness the kite and ordinary paper balloon. The philosophy of this feeling we do not profess to understand; perhaps it is the satisfaction of overcoming the usual course of nature. Be that as it may, this feeling is immeasurably heightened on beholding a body of the size of Mr. Wise's balloon, some twenty feet in diameter, cleaving its way through the air to the skies. Even without the additional interest of a person ascending with it, the ascension of so large a body would at any time fix the attention of a whole population for hours. But when there is connected with it the idea of a human being carried by its resistless power thousands of feet into mid-air, and suspended over the earth at this dizzy height, with nothing but a slender willow basket between him and inevitable destruction, the excitement and interest become almost painful by their intensity. No one will forget the sight till his dying day.

"The ascension of Mr. Wise was an unusually beautiful one. He rose from the garden at an angle, moving off north-westwardly, and at the same time rapidly ascending, so that before he had passed the city limits he was greatly above our highest steeples. Having gone perhaps a couple of miles in that direction, continually increasing his distance from the earth, the balloon, taken by another current of air, was borne more northwardly, and for a short time seemed bound for Trenton Falls, till an *eastwardly* current took it and passed it, hovering over the Deerfield hills, in review of the city. In less than thirty minutes this great fabric, which had gone out of the garden with such a rush, having gradually diminished to a mere speck against the clouds, went down out of sight beyond the hills.

"Mr. Wise says that, immediately on rising, the whole country around was visible to him; the villages, the streams of water, the fields and forests; the whole appearing as if scattered upon a vast plain, and like an immense

garden of indescribable beauty. He was so much elated by the richness and beauty of the prospect, that he could not forbear crying out with enthusiasm, 'Hurrah for old Oneida!' His field of vision extended about thirty miles each way. The south was everywhere full of the evidences of a fertile and thickly-settled country, the distant villages appearing like dots on the surrounding verdure, the roads traceable for miles like yellow threads, the water in a thousand places flashing in the sunlight. To use his own expression, 'If the felicity of heaven is comparable to the pleasurable enjoyment experienced when thus viewing the earth beneath one, it is worth a lifetime's devotion for its attainment.' He says that he was surprised at the appearance of Utica, which from his ground-view he had taken to be a very regular place, but from his elevation, it was the most singular place he had ever seen. The streets were a perfect snarl, the plan of the city exhibiting entire irregularity and its boundaries presenting several sharp points. To the west he could see part of a lake (Oneida), and along the north-east, for an immense extent, lay an unbroken wilderness ('John Brown's tract'). The fear of getting into this region, and being thus unable to fulfil his engagement at the Garden, at eight o'clock the same evening, kept him from going above the clouds, which he reached at one portion of his voyage.

"The course of his voyage he describes as being something like the letter S. When he appeared to us sailing along this side of the summit of the Deerfield hills, he was, in fact, three or four miles the other side, and the descent we witnessed was made at about that distance beyond the top of the hill where he appeared to land. His highest point was made as he was coming from the north, eastward towards the railroad. He then attained a height of about five thousand feet, or nearly a mile. As he passed along he could hear the shouts from the farmhouses below, but could not distinguish persons. At the easternmost point of his trip, seeing a village (Russia), with a convenient steeple for him to descend upon, he discharged some of the gas and commenced descending, but, as he thought probable, he came again into the westerly current of air which he took on first ascending, and by which he was carried three or four miles, at the height of a few hundred feet only from the earth. In this way he passed over a large forest, and coming to a suitable field, he threw out his line and drew his balloon towards the ground, and finally catching hold of a stake in the fence, made fast, forty-five minutes from the time he left the Garden, ten miles from the city. He employed a couple of men to tow him back to Utica, intending to make his first landing in the City Garden, but a storm coming on when he had got within sight of the town, he discharged the gas and packed up his balloon."

In two weeks, another ascension was made from Utica with about the same success and details.

Our Government being now at war with the Mexican nation, and hostility between the two countries growing stronger every day, it was determined by our War Department that the formidable Castle of San Juan de Ulloa should be reduced. Various projects were under consultation at Washington designed to such an end, upon which I thought it proper to submit the following to our government:—

*Easy Method of Capturing the Castle of Vera Cruz.*

The present condition of the war with Mexico will require our forces to reduce Vera Cruz. And it is acknowledged on all sides to be an extraordinarily well fortified point of defence, almost impregnable to the common mode of warfare, and at best cannot be taken in that way without a great sacrifice of life and ammunition. I will therefore suggest a plan to our War Department, which will render the capture of the Castle of San Juan de Ulloa as feasible and easy as the launching of a frigate.

Although the plan I shall propose may seem novel to many, still a brief detail of it, I think, will satisfy the most incredulous of its efficiency. In the first place, it will require a balloon of common twilled muslin, of about a hundred feet in diameter. This machine, properly coated with varnish, will retain its buoyancy for many days or weeks. It will be capable, when inflated, to raise over 30,000 pounds. Say 20,000 independent of its own weight, network, car, and cable. It can be inflated in a day, or less time if necessary. The process of inflation may be accomplished on land, or on board a man-of-war at sea, as circumstances may require. The car to be laden with percussioned bombshells and torpedoes to the amount of 18,000 pounds, which will leave two thousand pounds for ballast and men. Thus it will be ready to be placed in a position for deadly action, in a very short time. The cable by which it is to be manœuvred may be at least five miles long, so that the balloon at a mile of elevation would leave the vessel, or land position, which act as the retaining point, out of the reach of the castle guns, and under the cover of our own batteries. The man-of-war balloon hovering a mile above the castle like a cloud of destruction, would be entirely out of danger of the enemy's guns, since they could not be made to

bear on an object immediately above them. The position of the balloon as to height, and distance from the retaining point, could be maintained by keeping a proper eye to its ballasting. As it would become lightened by the discharging of shells and torpedoes, an adequate quantity of gas can also be discharged.

If a gun from the castle could be ever made to bear upon the war balloon, it would soon be silenced by the rapidity, precision, and certainty with which the deadly missiles could be showered down upon them.

With this aerial war-ship hanging a mile above the fort, supplied with a thousand percussioned bombshells, the Castle of Vera Cruz could be taken without the loss of a single life to our army, and at an expense that would be comparatively nothing to what it will be to take it by the common mode of attack.

Through the medium of your journal I would most respectfully suggest this plan to our Government, and will tender my services for its construction, and when constructed, will, if necessary, most cheerfully undertake its directorship into actual service, at a moment's warning.

Yours, respectfully,

*Lancaster, Oct. 22nd,* 1846. JOHN WISE.

The proposition drew out a great many opinions and commentaries upon the plan, one of which we will state, taken from the 'Philadelphia Public Ledger.' "The public have been amused by the many comments upon Mr. Wise's plan of taking San Juan de Ulloa by balloons, lading them with men and explosive bombs, raise them over the devoted castle, and let the bombs fall upon it and blow up by concussion. This new method of besieging a fortress has been discussed in every vein of seriousness, wit, or contumely, as the idea seemed feasible, funny, or absurd to various minds. At a recent party in Frankfort, Ky., the subject became a topic of conversation. After a number of persons had said their say, pro and con, a distinguished wit—an ex-governor of the State—was called upon for his views touching the same. With great dignity he pronounced the plan an admirable one, and the inventor a man of military genius; but, he added, 'I think it will be a very troublesome matter to enlist volunteers for that service.'"

Soon after this, the following note was addressed to the War Department:—

*Ex-Governor Marcy, Secretary of War of the United States.*

SIR, Lancaster, Dec. 10th, 1846.

You have no doubt seen, and perhaps somewhat considered over the plan and proposition I suggested through the public prints, for the reduction of the Castle of San Juan de Ulloa by balloon. Were it not for the incredulity and prejudice that invariably meet new ideas and projects, I should from the commencement have submitted it to the War Department, for scrutiny. But believing that it would best be tested by "public opinion" in bringing out serious objections to its feasibility, I chose the course of having it first analysed in the popular crucible. By this course I should be enabled to discover, what in my first conceptions of the plan might have been overlooked, and thereby save myself the trouble of further urging its merits towards action, as also any formal application for its consideration by the War Department.

So far from any well-founded objections having as yet been urged against its practicableness, I have some of the best minds in the country to sustain the project. And upon a mature and deliberate review of the whole subject, in its minutest details, I write to you with a most unwavering conviction of not only its practicability, but my ability to give it the desired effect. It will be unnecessary for me at present to enter into any detailed account of the necessary requisites to its consummation; but I will state, that the cost of outfit, independent of the war projectiles, would be but a trifling matter, compared with the magnitude of the work it would be capable of accomplishing. As to the objections that may or can be urged against its feasibility, I am ready to rebut them with mathematical and philosphical demonstrations. Should the War Department desire to have further explanations of its character, or to have any objections to its practicability refuted, they will be explained and met by me upon the first intimation of such a request. The novelty, or chimericalness of its character, will, I trust, have but little weight upon the minds of the intellect composing our Government in deterring them from a fair and impartial scrutiny of a subject so pregnant with national welfare.

It has been hinted that it would be difficult to get men that would act in such an enterprise.—This belief is as unfounded as any other I have yet urged against it. It would require but nine assistants in the bomb-car, and that number I will guarantee to secure from our own city.

With an earnest solicitude for its early consideration, I remain your fellow citizen,

JOHN WISE.

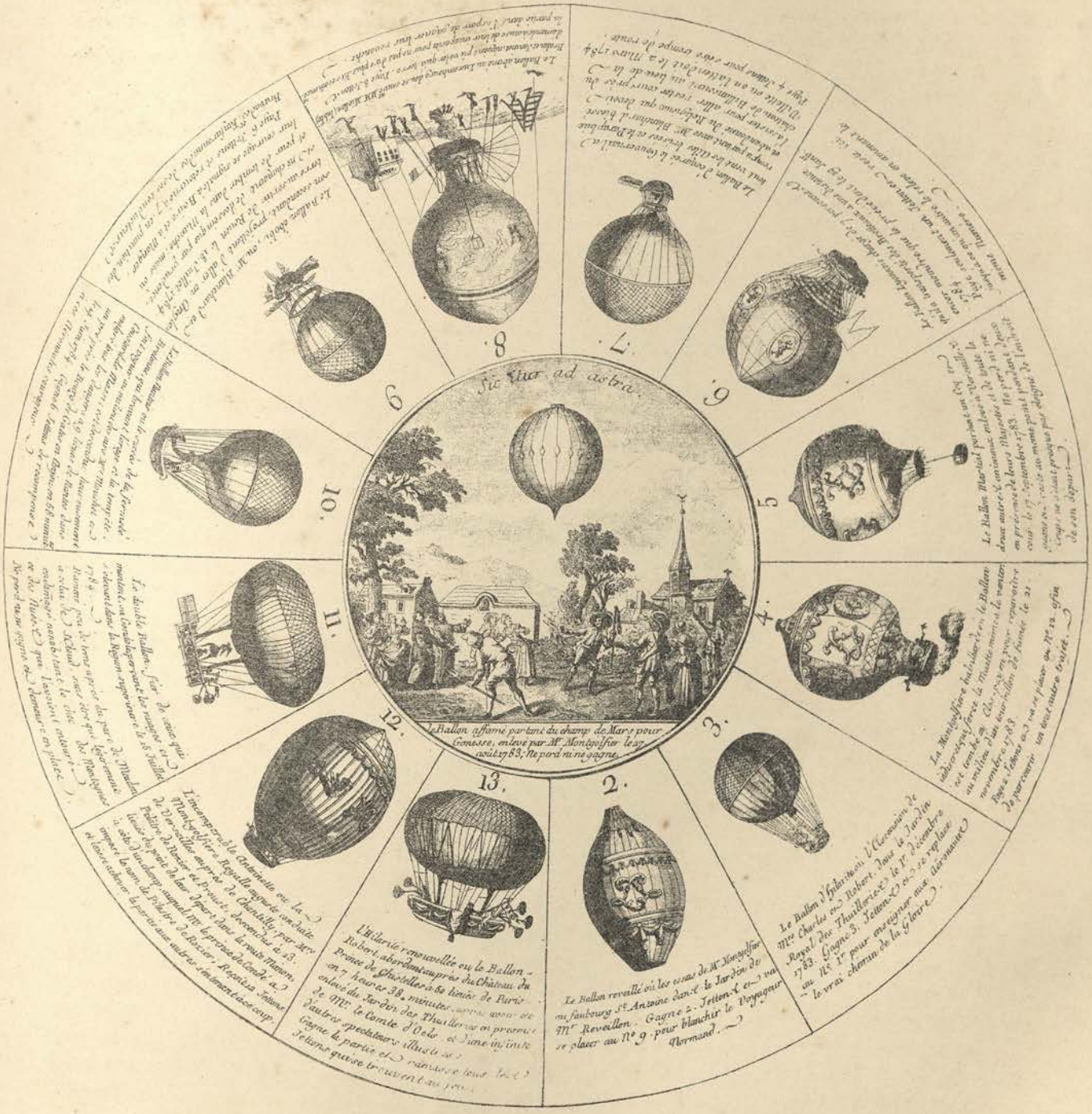



Photo-zincographed at the Ordnance Survey Office, Southampton, under the superintendence of Capt.n H. Helsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director.

1847.—Albert Smith gives two graphic accounts of his ascents this year. The first is dated July 5 :—

The veteran aeronaut, Mr. Green, made one of the best ascents, in his Nassau Balloon, that has been witnessed for some years; taking with him no less than ten companions for a journey through those paths of air with which he only may be presumed to be intimately acquainted.

The evening was very fine. There was scarcely any wind; and what there was, blew, in the general currents, towards the east; but this was hardly perceptible, the leaves on the trees being perfectly still. A vast number of spectators surrounded the Gardens; and the grounds themselves were crowded by holiday-makers, as much in expectation of witnessing the ascent, as to enjoy the beautiful foliage and freshness of Cremorne. Within the ring we observed Lord Adolphus Fitzclarence, Mrs. Milner Gibson and party, Sir George Wombwell, Capt. Tyrwhitt, Mr. Henry Villebois, &c.; and many popular *artistes* of the day, including Mdlle. Carlotta Grisi, Mdlle. Petit Stephan, M. Perrot, Mr. T. P. Cooke, Mr. Buxton, and others.

At seven o'clock the travellers took their places in high mirth, the car being occupied by Mr. Ibbetson, Mr. Davidson (of the Garrick Club), Mr. Shirley Brooks, Mr. Drew, Mr. Morris Power, and Mr. Green himself; whilst, on the hoop of the netting, some four or five feet above them, were perched Mr. Albert Smith; Mr. John Lee—a gentleman well known in the theatrical circles; Mr. P. Thompson, of Guy's Hospital: Mr. Spenser—who accompanied Mr. Green when poor Cocking lost his life, and who now had the command of the "butterfly-valve," which liberates the gas; and a friend. Everything being pronounced "all right," the word was given to "cast off," and the Balloon rose. We will now adopt the account of a traveller on the occasion :—

"The first sensation experienced was not that we were rising, but that the balloon remained fixed, whilst all the world below was rapidly falling away, until the cheers with which they greeted our departure grew fainter, and the cheerers themselves began to look like the inmates of many sixpenny Noah's arks grouped upon a billiard-table—or perhaps, rather, the distinguished company who are assembled round the model Indian palace in the Public Dining-room at Hampton Court. Then they grew smaller and smaller, and we thought of the Colosseum view; until at last the *coup d'œil* got too grand in its diminutiveness to liken to anything.

"There was but one idea, at the same time, dominant in the minds of everybody. Was it possible that the small specks who moved along the thread-like scratches that we knew were streets, or scuffled about on carriages, evidently from the mews of the industrious fleas, were fellow-creatures? Why, our hats would have held millions, and an emmet could have walked amongst them like a Megatherium! We never felt so humiliated as when we were forced to admit that we were of them—that we had appeared in the same contemptible light to other aerial travellers hundreds of times before.

"No one, who has not seen London from a balloon, can form the weakest notion of its vast extent—its interminable suburbs, stretching on and on, in all directions—its large enclosed fields, and gardens, and pleasure-grounds, where none were supposed to exist, by ordinary passengers. And most strange is the roar of the city, as it comes surging into the welkin, as though the whole metropolis cheered you with one voice. You would imagine that mighty crowds below were huzzaing you on your way: and yet none beyond the ordinary passengers are to be seen. The noise is as inexplicable as the murmur in the air at hot summer noontide.

"You are not conscious of any motion; neither, going with the wind, do you perceive its slightest breath; and the only way by which we could tell we were moving was by throwing bits of paper out. The neck of the balloon, however, collapses when it is sinking; and it is always open, to allow the escape of the gas, which expands on reaching a more rarefied atmosphere—otherwise it would burst.

"The new Houses of Parliament presented very interesting objects—the entire pile having the appearance of a delicate card-board model. The steamers on the river made, also, a very beautiful effect, leaving two long wings (if we may so call them) of foam behind them, similar to the trains of a table rocket—those fireworks which rise like birds, without sticks; and the rowing-boats looked like caraway-seeds.

"The balloon did not take a perfectly straight direction, but changed its line according to the currents. Our course was over Chelsea, the Penitentiary, St. George's Fields, Southwark, Rotherhithe, the Isle of Dogs, Blackwall, Plaistow, then nearing Woolwich, going northwards slightly to Barking Levels and Dagenham Marsh, again keeping over the river, and finally descending on Wenington Level, near Rainham, in Essex, opposite Erith—having crossed and recrossed the Thames several times.

"It was curious to see the four railways—the Blackwall, Greenwich, Brighton, and Eastern Counties—all at

once, with the specks of trains moving along them in both directions. As we passed Blackwall, the murmur of London grew fainter and fainter, until a deep and almost awful silence reigned. We were then 5200 feet high. The rich ground about the river Lee, with the Limehouse Cut; the Park at Greenwich, the grounds and woods of Charlton, and the vast expanse of the Essex marshes, all formed pleasing objects. We had not eyes enough to look about us, nor tongues sufficient to call each other's attention to fresh points of interest. Here we had some champagne—which appears to be an indispensable adjunct to a balloon voyage—and then, whilst crossing the river, threw down the empty bottles. Their disappearance, far below us, had an odd effect.

"The view of the country is not so interesting as that of the metropolis. Those who know the prospect from the top of the Rigi, in Switzerland, have seen a much finer bird's-eye panorama than can be got from a balloon. It has simply a map-like appearance—very like what the view would be coloured, which was the frontispiece to Tombleson's Rhine.

"A spot having been selected to descend upon, Mr. Green threw out the grapnel—a tolerably substantial affair—and we were ordered to 'hold tight.' It was as well that we did so; for every time the iron catches in the ground the balloon is pulled up suddenly, with a shock that would soon send anybody from his seat—a jerk like that which occurs when fresh carriages are brought up to a railway-train, but more violent. At last it held firm, and then the car touched the ground, with a bump that somewhat disconcerted the passengers, as the occupants of the hoop, at the same time, came down upon their heads. But some labourers appeared from an adjacent farm, and, holding on, we were soon enabled to get comfortably out, and stand once more upon the ground—which belonged to Mr. Blewitt, of Rainham.

"The strangest feeling of all, after our imperceptible journey, was to find ourselves on the Essex marshes, with the shouts of Cremorne still ringing in our ears. We assisted to pack up the balloon, which goes into the car as a travelling-case, and then the question arose as to the means of return to London—for the marshes are not places where you can call a cab or wait for a train. We had to walk on to Rainham—a good three miles—and there at the inn we found an omnibus and three horses.

"We could see that the rustic inhabitants scarcely looked upon us as mortals. They regarded us with open eyes and mouths, and appeared disinclined to believe in the proffered hospitality of beer, which we offered them. But after a time their misgivings vanished, and we formed a merry party until the horses were put to—which, at Rainham, is a process occupying three-quarters of an hour. At length, engaging a cart for the balloon, we started off for London, and arrived safely again at the West-end about one o'clock.

"From the delight we all experienced, we counsel everybody to go up in the balloon, and enjoy the journey—which they are sure to do—as much as we did. In spite of the apparent frightful fragility of cane and network, nothing can, in reality, be more secure. Mr. Green is a steady, cool-headed gentleman: the stories of pressure on the ears, intense cold, and the danger of coming down, are all fictions, invented by those who must make 'adventures' out of everything that befalls them; and the sensation is one of the most novel that can be experienced, and, at the same time, deliciously agreeable. Indeed, we almost wanted a few perils to give a little excitement to the trip; and have some notion, if possible, of going up the next time at midnight, with fireworks, in a thunderstorm, throwing away all the ballast, fastening down the valve, and seeing where the wind will send us."

Albert Smith's account of his second trip, in Mr. Gypson's balloon, and its perilous descent, is thus given :—

Since the 15th of October, 1783, when the daring Marquis d'Arlandes and M. Pilâtre de Rosier first trusted themselves to a fire-balloon, there have been few ascents made which terminated in so nearly fatal a manner as that from Vauxhall Gardens on Tuesday night. Setting aside the hapless attempt of the latter aeronaut and his companion, M. Romain, whose balloon caught fire at an elevation of 3000 feet, and who were dashed to earth, and killed on the rabbit-warren at Wimereux, near Boulogne, the adventure which comes nearest to the one on Tuesday night was that of Signor Carlo Brioschi, the Astronomer Royal at Naples, and the Italian aeronaut, Signor Andreani. Trying to rise higher than M. Gay-Lussac had done a year or two before, they got into an atmosphere so rarefied that the balloon burst. The remnants checked the velocity of the descent; but Brioschi was so injured that it ultimately brought him to his grave.

When I stated, half in joke, a fortnight ago, in the account of a trip in the Nassau Balloon, written for the

'Illustrated News,' that, for further excitement, I would next ascend at midnight, with fireworks, without ballast, and the valve closed, I little thought how soon three of these conditions would be realised—the fourth being carried out in an entirely opposite manner. Anxious to see a view of London by night from a great height, I arranged with Mr. Gypson for a seat in his car; and, finding that Mr. Wardell, the proprietor of Vauxhall, had fixed the evening for Tuesday last, I went to the Gardens about eleven o'clock. The night was uncommonly close and sultry, and scarcely a breath of wind was stirring; what there was blew lightly from the south-east; and the lightning was repeatedly flashing about the skies, preluding the thunderstorm with which, our readers may remember, the metropolis was visited on the evening in question.

I found that two gentlemen, besides the owner of the balloon, were to be my companions—Mr. Coxwell and Mr. Pridmore. The balloon itself was a very fine machine—not so large as the Nassau, but higher, I should conceive, than any of the others used for single ascents. It had lifted seven people from the ground just before I got there, and appeared in every way calculated to make a good ascent.

The fireworks—the frame of which resembled a very large skeleton drum—were to be hung some thirty or forty feet below it, and fired from the car by a fusee—a most dangerous method, by the way, as the neck of the balloon is but a few feet overhead. I must confess that the preparations gave me some uneasiness; there was too much confusion—too much noise—too many suggesting and interfering all at once; altogether different to the tranquil and collected manner in which Mr. Green had taken us up a week or two before.

At last, however, everything was pronounced ready to start. We took in some "stores" for the trip, as, had it been quite dark, it was the intention of Mr. Gypson to have remained up all night; and with six or eight bags of sand for ballast, gave the command to "let go." The band played "Off she goes!" the View of Venice was lighted up with blue fire: the people huzzaed, and the balloon rose with extreme velocity, shooting straight up at once, but turning round as it ascended. The first attempt to light the match of the fireworks failed; but it caught readily at the second, and then they began to shoot out cascades of coloured fires, which had a very beautiful effect, and must have looked exceedingly imposing from the Gardens, as they tinged the air round us.

It is impossible to form the feeblest idea of what the appearance of London is, seen by night, from the elevation we had now attained—as nearly as could be judged from the apparent breadth of the river at the bridges, about four thousand feet. In the obscurity all traces of houses or enclosures are lost sight of. I can compare it to nothing else than floating over a dark blue and boundless sea, spangled with hundreds of thousands of stars. These stars were the lamps. We could see them stretching over the river at the bridges, edging its banks, forming squares and long parallel lines of light in the streets, and solitary sparks—further and further apart, until they were altogether lost in the suburbs. The effect was too bewildering—too novel and extraordinary to allow any of us even to speak; we could only gaze on them in rapt and deep attention.

The fireworks had commenced at Vauxhall, and we saw the blaze of light about the gardens very distinctly, as well as the explosions of the rockets; and a flash of lightning now and then illuminated the entire panorama, but too transitorily to catch any of its features. Above us the sky was deeply blue, studded with innumerable stars; in fact, above, below, and around, we appeared sailing through a galaxy of twinkling points of light, incalculable and interminable. The impression made on my mind in these few minutes will never be effaced; neither will the scene by which it was so speedily followed.

We were still going up, higher and higher, until the gentlemen assured us we had attained the height of 7000 feet—nearly a mile and a quarter perpendicular—when Mr. Coxwell, who had charge of the valve-line, and was sitting on the hoop of the netting above us, informed Mr. Gypson that the balloon was getting very tense, from the extreme rarefaction of the external air at the elevation we had attained. An order was immediately given for him to "ease her," by allowing some of the gas to escape by the top valve. It may be necessary to explain that the top of a balloon is furnished with what is termed a "butterfly valve"—a circular double-flap trap, opening downwards by a cord which passes through the interior of the balloon, and closing again with a spring when sufficient gas has escaped, which it readily does by reason of its buoyancy. Mr. Coxwell pulled this line, and immediately afterwards we heard a noise, similar to, but not so loud as, the escape of spare steam in a locomotive; and the lower part of the balloon collapsed rapidly, and appeared to fly up into the upper portion. Mr. Gypson cried out immediately, "Good heavens! what has gone?" to which Mr. Coxwell answered, "The valve is gone! we are all dead men!" or words to that effect; and that same instant the balloon began to fall with appalling velocity; the immense mass of loose silk, surging and rustling frightfully over our heads, as it

flapped to and fro, like the sails of a ship when tacking, between the network and cords by which our car was slung, retreating up away from us more and more into the head of the balloon.

Two of our party directly gave way to exclamations of extreme terror, in the midst of which the suggestion was made to throw everything over that might ease the balloon. I had two sandbags in my lap, which were cast away directly, and Mr. Coxwell lowered himself from the hoop into the car, when we all began to hunt about amongst our feet for whatever we could find. There were several bags of ballast, and some bottles of wine or brandy, and these were instantaneously thrown away; but no effect was perceptible. The wind still appeared to be rushing up past us at a fearful rate; and, to add to the horror of these few moments, we came amidst the expiring discharge of the fireworks, which floated on the air; so that little bits of exploded cases and touch-paper, still incandescent, attached themselves to the cordage of the balloon, and were blown into sparks. The lightning, which so shortly merged into the storm of Tuesday night, was playing about us uninterruptedly—it had done so during our ascent—and the whole machine soon began to oscillate frightfully. I afterwards gave a rude sketch of our position at this time to one of the gentlemen connected with the artistic department of this paper, and he has reproduced it in a graphic and faithful manner in the accompanying engraving.* I presume we must have been at this period upwards of a mile from the earth; but the only way I had of judging, was by comparing the boundaries of familiar localities with what I had before seen when up with Mr. Green.

"What were your feelings at this moment?" is a question that I was asked scores of times on Wednesday by friends who called to hear about the accident; and my readers also may wish to know. After the first start, then, when the valve gave way, I felt collected and tranquil, to a degree almost preternatural; but every impression, of the most trivial kind, appeared to be made with tenfold intensity. I have still the appearance of the lights on the earth before my eyes, almost as vividly as when I was looking at them—as though their forms had been so forcibly impressed on the retina that they were retained there. I could see the fireworks still going on at Vauxhall, and I looked after the river, in a wild hope that we might fall into it, when there would still be the chance of a swim for life. But this, as we shall afterwards see, must have terminated fatally.

How long we were in descending I have not the slightest idea; but two minutes must have been the outside. At one position I threw away an envelope from my pocket, to judge, in a vague manner, of our speed; and the rapidity with which we left it floating behind proved that our velocity was frightful. The parallelograms of light, too, formed by the squares, got visibly larger and larger, like an image in a phantasmagoria; and the oscillation of the balloon did not appear to be so violent, although the car was still swinging. I attribute our preservation alone to the fact of the upper netting of the balloon having kept firm, preserving the empty silk in an umbrella shape, which acted as a parachute. We now saw the houses, the roofs of which appeared advancing to meet us; and the next instant, as we dashed by their summits, the words "Hold hard!" burst simultaneously from all the party. Calculating the distance as closely as possible, as the car took the ground on a slant, I caught hold of the hoop, and jumped towards it, thus breaking the first shock, which, it need scarcely be said, was very violent.

We were all directly thrown out of the car, along the ground, and amidst the cordage and silk of the balloon, part of which, I think, had caught upon a scaffold pole; but it appeared to be entirely emptied of its gas. We were so entangled in the netting, having got our arms, heads, and legs into the meshes, that at first we could not move; and I then saw that a fall in the Thames would have ended in certain death. There was a large crowd of people immediately about us, and they assisted us out of our embarrassment, testifying in a very hearty and impulsive manner, their joy at our extraordinary escape. For, incomprehensible as it now appears to me, nobody was seriously hurt. Torn clothes, crushed hats, and a few grazes and bruises, were all the evils that resulted from a descent of a mile, without gas. We found we were in one of the new streets—a very small thoroughfare—between the Vauxhall and Belgrave roads, and not above a mile from the Gardens, if so much. As my brother and a great number of friends were still there, I was anxious to get back before any other account of the occurrence reached them; and my three fellow-travellers having the police to aid them in packing up the balloon, I availed myself of a cab, kindly placed at my disposal by a gentleman who drove up at the moment, and drove quickly back to Vauxhall, where I met a friend at the gate in great alarm, having just heard that the balloon had fallen, and that we were (of course) all dashed to pieces. Mr. Gypson and the other gentlemen soon after arrived, with the

* See 'Illustrated London News.'

balloon; and the cheering that greeted the return of the party thus providentially rescued, was far more hearty than that which had accompanied the ascent.

And now a few words in conclusion to aeronauts in general, as well as the proprietors of *al fresco* places of amusement. I hope that no more night ascents will be permitted. Nothing is gained by them. If the great attraction is the view of the fireworks in the air, they could be sent up by themselves, with a pilot balloon, and present an equally brilliant effect—possibly a superior one. Should they still be persisted in, some frightful accident, and succeeding inquest, will certainly stop them, by authority.

The question put to us by Mr. Wardell, just before the ascent, which was, "Gentlemen, do you go up by your own free will, and have you confidence in the arrangements?" almost inclines one to believe that some danger—it might have been but slight—was apprehended. I speak perfectly disinterestedly. The accounts hitherto furnished of the night ascents have usually been given by the aeronauts themselves to the reporters; and, therefore, the real risk of the venture has never been made known.

And I would recommend Mr. Gypson to have his balloon thoroughly examined by competent persons before he attempts another ascent. He stated, on his return, that the state of the atmosphere affecting the gas, produced much unforeseen inconvenience; but something must have been mechanically wrong in the arrangement of the valve, or the mere pulling of the line would not have led to a catastrophe so nearly terminating in the loss of four lives.

Since the above was written, Mr. Coxwell has published an excellent statement of the manner in which the accident occurred. He says that the balloon burst before the valve-line was touched, the valve being found unmoved upon subsequently examining the balloon; and it is also ascertained that he remained on the hoop until the concussion. In other respects, his account agrees with the above; the first impression of all the parties being that the valve itself had gone.

ALBERT SMITH.

Mr. Coxwell's account is as follows :—

Various rumours, in addition to conflicting written statements, having been circulated as to the cause and result of the precipitate descent of Mr. Gypson's balloon on Tuesday evening, near the Belgrave-road, Pimlico, an explanation of the circumstances of the mishap may probably prove interesting. After rising from the Gardens with an ascending power calculated to ensure a clear start, and to give full effect to the fireworks, which were suspended by means of a line from the hoop, the balloon took a course at first across the river, in the direction of the new Houses of Parliament. A few seconds had scarcely elapsed, before the first whiz and flash indicated the combustion of the pyrotechnics.

* * * * * * * *

For an hour and a half before we started the lightning was incessant, which elicited from our friends and several of the spectators apprehensions for our safety; and no sooner had the fireworks been discharged than a vivid flash occurred, and for the moment it appeared as if the heavens were on fire, and that our destruction was certain. The appearance of the regions above was awfully grand. The expansion that succeeded was immense, and we all were convinced that the gas was escaping from the neck. Mr. Gypson immediately took the valve-line, with a view of relieving the upper part of the balloon. That operation was unfortunately delayed a few seconds too long; for, notwithstanding that the lower valve was fully open, the silk sustained a fracture, which occasioned us to drop and hang a considerable distance under the balloon. The responsible, and, indeed, critical position I filled, provoked the charge of my having done something that was uncalled for; and in consequence of its being groundless I state thus much. In an instant the ballast was discharged, and the line connecting the lower valve to the hoop immediately cut. The silk then formed, as it were, into a spacious and perfect parachute, and we descended with gyrations indicative of rapidity and also danger. Presently myriads of the gaslights which shone so brilliantly but a moment before, appeared to be rising to us, and instantly the car and the ground came into fearful collision. The spot where we descended was close to some unfinished houses and building materials in the Belgrave-road, Pimlico, about a mile from the Gardens. Our course having been semicircular, providentially we all escaped without injury, and the balloon is but slightly damaged. I have no hesitation in stating that had the valve been opened sooner the accident would not have happened.

On the 24th July, Mr. Wise made an ascension from Auburn, in New York State. He says:—

Auburn is a flourishing and beautiful town, situated about twenty-five miles west and a little south of Syracuse, making it a favourable point to reach Syracuse from, by the upper current which always blows from west to east. It was a magnificent voyage, and the main part of the journal is worth a perusal here, to wit:—Up, up I soared, almost perpendicularly, until an altitude of at least a mile and a half was reached, when I began to look around me, and then, great God!—yes, I made the exclamation again as I was sitting with my pencil and log-book in hand, riveted to the sight—great God! what a scene of grandeur! Oft have I enjoyed and revelled in the intellectual indulgences of nature's luxuries. Many, many beautiful and magnificent scenes have I witnessed, but this surpasses all. Such were my involuntary exclamations. I looked around again and again, still the reality seemed like a splendid dream—an enchantment—it was too rich a scene to be deprived of by a short trip. After I had viewed and reviewed the vast panoramic plain, and wondered at and admired the handiwork of the Creator—its amplitude and order, I would try to settle my mind down to a cool and descriptive standard, but admiration and amazement had enchained my thoughts alone for nearly one hour, and ejaculations flowed over the glorious spectacle beneath me. The vastness of the scene, extending nearly a hundred miles each way (the atmosphere was very transparent), beautifully interspersed with lakes; the innumerable villages, many of them glittering with silvery domes and spires; the tiny and tastefully decorated prison-house at Auburn; the thousands of variegated grass-plats; the golden tinge of the waving grain-fields; the glossy surfaces of the lakes dazzling in the sunbeams; the lights and shadows over the general surface caused by a partly clouded sky; the huge precipices of clouds lying to the east and partly beneath me; the wide mirror-like surface of Lake Ontario, with its fringed southern border; the cities in the evanescent distance decorated with brilliant specks, with a thousand other things, so completely absorbed my mind that when I looked at my watch I found that I had been aloft one hour and ten minutes.

Looking up at the balloon, I found her discharging gas at the safety-valve. Although but half-filled when she left the garden at Auburn, the immense machine was now full and distended to the utmost tension, showing that my altitude was over two miles. A cluster of detached clouds was hanging between me and Syracuse, some distance off. Here I took another observation of the lakes, and counted thirteen in view—Lake Ontario looked like an immense sea, its northern boundary lost in the distant heavens. After being aloft one hour and a half I found myself crossing Onondaga Lake, having northed too much for Syracuse, and making direct for Liverpool, a village five or six miles above the latter place, near which I made a landing, breaking the Oswego telegraph wires with the grappling-iron.

The balance of the account is best told by the 'Syracuse Journal.'

A Speck in the Horizon.

"When Mr. Wise had determined upon making an ascension from Auburn on Saturday he assured several of his Syracuse friends that should the weather prove favourable he would endeavour to pay them a flying visit, and possibly take tea with them on Saturday evening. This was thought a very good joke.

"A few minutes before five o'clock Saturday afternoon, as a number of the more credulous were on the 'look out,' they thought they espied something far at the south-west that *might* be a balloon. It was no bigger than a man's hand, to be sure, but it moved 'like a thing of life' through the vast expanse, guiding itself majestically like some proud 'Lord of the boundless realm,' and gradually increasing in size as it approached. Ere long all doubt was at an end. The *balloon* and its voyager were now fairly in view. It was a glorious, a beautiful sight! and thousands in all directions were wrapped up in its admiration. The course of the balloon was to the north-east, and it passed directly over Geddes, thence over Onondaga Lake to Salina, when Mr. Wise began to descend. In lowering his ship a sub-current of air carried him towards Liverpool; and at thirty-five minutes past five o'clock he landed on Mr. Waterbury's farm, about six miles from this village. There he was soon met by numerous friends, in carriages, from Syracuse, who had followed his course.

"In making his descension, Mr. Wise still kept the balloon inflated, and soon made his appearance in our streets, seated comfortably in his car, ready for another trip to the 'ether blue.' A farmer's waggon piloted the aeronaut and his apparatus through Salina-street to the Syracuse House. Here, as may readily be supposed, a

large crowd gathered. Mr. Wise was evidently much pleased with the success of his journey, and the welcome he had received. To gratify curiosity, and at the request of many, he prepared and made an ascension from the open space in front of the Syracuse House about seven-and-a-half, amid the shouts of the crowd. He travelled a short distance west, landing somewhere in the vicinity of Geddes. At half-past eight o'clock he returned to Syracuse, and redeemed the promise to take tea with his friends."

My next ascension was made from Buffalo, and the first successful one that had ever been made from that place, as I was informed.

AERIAL LOG-BOOK OF SIXTY-SECOND VOYAGE.

*Memoranda.* Buffalo City, Morris' Garden, July 31st, 1847.

Four P.M. precisely, started with aerial ship 'Rough and Ready,' under ballast and brisk gale from the S.S.W., wind moving at the rate of a mile per minute. Started with considerable ascending power; but the current was so strong that in order to make a more perpendicular rise thirty pounds of ballast were thrown overboard, which having lightened the vessel, and a strong gale blowing against it as it rose, caused it to pitch and gyrate with a desperate motion, which turned the balloon about one-third round in the network, and made the valve partly unmanageable.

My first observation was the place I had left, which was five minutes afterwards. The city, although covering much territory, seemed compressed into an area of a hundred miles square. Lake Erie appeared tapered off to a narrow ragged pond on its eastern extremity; then it diverged into two narrow silvery threads, which reunited again around a small green plat. Upon reflection I concluded this must be the Grand Island, and immediately my attention was drawn to a search for Niagara Falls, as I heard a slightly rushing noise of waterfall. My eye soon rested upon it; and after scanning it for a few moments I involuntarily cried out, "Is that the Falls?" And no wonder, for it looked like a cascade, such as we see in pleasure-gardens. I was disappointed; for my mind had been bent upon a soliloquy on Niagara's raging grandeur, but it was a bubble; it looked too small.

The scenery of the great panorama surrounding it could only absorb my mind. The little frothy bubble had too much the appearance of a foaming glass of London brown stout; and it was insufficient of itself to excite an idea beyond that. It looks like a little humbug when viewed from the clouds. The scenery around was not so pleasing as that presented around Auburn, and Syracuse, and Utica. Here the country appeared dry when viewed away from Lake Erie. A vast plain well wooded, with few roads and less villages, it was altogether of a barren cast.

I made a landing at Williamsville, and was within a few feet of grappling into their church-steeple, which might have caused serious consequences to it, at the rate the balloon was moving, had it caught into it. This is distant from Buffalo twelve miles.

The Buffalo 'Express' says of this experiment:—"The ascension was made under disadvantageous circumstances; but so perfect and so beautiful was it as to settle in the minds of the people of Buffalo—a large concourse of whom honoured the occasion with their presence on the outside of the Garden—the fact that this aeronaut never fails."

A week after this another ascension was made from this place.

AERIAL LOG-BOOK OF SIXTY-THIRD VOYAGE.

Buffalo City, August 6th, 1847.

Left Morris' Garden at precisely six minutes past four o'clock with the aerial ship 'Rough and Ready.' Wind from the north, balloon rising slowly. Threw over some ballast—men, women, and children scrambling out of the way. Ascent became more rapid. Rising, and moving along parallel with Main-street—a little east of it. As I rose, the current bore for the lake; began to feel chilly upon the thoughts of a ducking. One mile out on the lake, threw out more ballast to reach the great eastward current. Got up a mile and struck a current at the rate of twenty miles per hour up the lake. This won't do; I shall get out ten or twelve miles before I can reach it, and then probably be blown into Canada, where I should stand a chance of arrest for *contraband*. Opened valve and came down within speaking distance, just over a brig going into Buffalo. "Ahoy! what vessel?" "Brig Eureka, Captain Burnell." "Will you lower a boat, Captain, if I come down?" "Certainly, sir,' answered Captain Burnell. "Then I'll be down presently." Came down with all despatch—the brig laid to, but I got astern of her several miles before her boat was lowered, and by that time my car struck the water.

The balloon first rebounded and glanced over the water in a ricochet manner, until sufficient gas was dis-

charged to sink the car some depth in the water. This retarded its progress up the lake, and I found the yawl, sent from the brig, was gaining on me. In a half-hour longer the boat was alongside, and took me in tow. The gas was soon all discharged: and in another half-hour I was safely aboard of the brig 'Eureka,' in company with the generous Captain Burnell, who took me into port that evening.

The Buffalo 'Daily Courier' made the following notice of the ascension:—"Yesterday afternoon, according to previous announcement, Mr. Wise made his sixty-third ascension from Morris' Garden, corner of Main and Tupper streets. Great interest was evinced throughout the length and breadth of the city to see it. All sorts, sizes, and conditions of people were assembled to witness his flight. We were glad to see a good number on the *inside* of the Garden. The *outside*, and indeed the adjacent streets and lanes, were filled with carriages, and a mass of human beings, all anxious to see what they could. After there had been several pioneer balloons sent up, and the curiosity of such as chose to examine the principal one had been satisfied, Mr. Wise prepared himself in the car for his lofty voyage. About four o'clock, after some preliminary trials, he gave the word, 'Let go,' and amid the cheers and hurrahs of the enthusiastic assemblage, he floated off most grandly. The ease and self-possession which he evinced, the confident air he assumed, showed to our mind conclusively that he was master of his profession. After he was up he went immediately over the city, in the direction of the lake, thus affording an excellent view of the ascension to the thousands on the housetops, etc."

Ascensions were made from Rochester and Oswego, N. Y., the same summer; both of these trips were of short duration, owing to the proximity of the lakes. In the account of the one from Rochester, the following, in relation to sounds, occurs:—There is but one point of peculiarity in the circumstances of my voyage made on Saturday the 14th of August, which is worthy of particular notice. I have always noticed that certain sounds, produced at the surface of the earth, have a remarkably peculiar effect upon the ear of the aeronaut when immediately over them. Waterfalls are of this kind in their noise. Even a common mill-dam produces a wonderful noise to one's ears when a mile above it. The Genesee Falls made a noise to my ears, when above them over a mile, a hundred times louder than did Niagara when I stood upon its brink.

I noticed the same peculiarity, particularly in the returning echo of my own voice, when over Lake Erie. There, the sounds of voice from the persons on board the brig 'Eureka' were remarkably clear and distinct to my ears when immediately over them, but still not so much so as was the echo-sound of my own words. This appeared even louder than the original utterance, and the enunciation quite as distinct. In the case of the words spoken from the brig they became fainter, and very indistinct, after I got at an angular position from them. From this it appears that the occasional sounds which greet my ears so distinctly when sailing along at great heights must arise from points immediately underneath me. The same peculiarity holds good in vision. Immediately below one, objects appear very distinct but very diminished from their real size, while at a great angular distance they appear diffused.

In my voyage from Auburn there appeared a very striking phenomenon regarding vision. I noticed in the account of it the lucidness of the atmosphere. But there appeared also a *locming* up of objects in the distance. Lake Erie, which was over a hundred miles off, seemed elevated ten or twelve degrees above the horizon, and yet composed part of the visible horizon.

Sound and vision are propagated distinctly in perpendicular lines from the earth's surface;—when heard and viewed in angular directions the resulting effects are diffused in both cases. This I have also noticed in the music when ascending. The tune played by a band of music as I ascended perpendicularly above them was distinct and clear; and when moving off in a rapid horizontal direction, it became very diffuse in a short distance. The firing of cannon, when it is done immediately underneath the balloon, agitates it violently, often with considerable depression in its lower side; but when the firing is at an angular distance, though much nearer than the perpendicular position just mentioned, it is not near so perceptible.

1848.—Mr. Coxwell went to the Continent, and ascended from Brussels, Antwerp, and Eberfeld. At Berlin he showed the use of shells for destructive purposes. At forty feet below the car a wicker battery was slung; to this he descended by a rope ladder, discharged grenades, or pétards, and then reascended to his companions. I much regret that he should not have favoured me with fuller details of these experiments from the accounts in

the German papers, but his many engagements will not now permit him to do so. Among the narratives he gave me *vivâ voce* was one of crossing the Sleswig-Holstein frontier in this year, when he was shot at by the German sentries, who took him for a Danish spy. On another occasion he went from Berlin in the direction of Dantzic, a distance of 170 miles, in three hours and ten minutes.

He ascended also from Vienna, Prague, Breslau, Leipsic, Hamburg, and nearly all the chief towns of Germany, and did not return to England till 1852.

1849.—The passage of the Alps was effected this year by M. Arban, in a balloon excursion from Marseilles to Turin, a distance of 400 miles, in eight hours. M. Arban gives this account of it :—

"I ascended from the Château de Fleurs on Sunday evening, the 2nd instant, at half-past six. At eight I was over the wood at Esteret, where I ascertained I was at the height of 4000 metres. The temperature of the air was cold, but dry; my Centigrade thermometer marked four degrees below zero. The wind was south-west, and sent me over Nice. For nearly two hours I was surrounded by very dense clouds; my cloak no longer sufficed to keep me warm; I suffered much from cold feet. I nevertheless determined to proceed and traverse the Alps, from which I knew I was not far distant.

"My provision of ballast was enough to raise me above the highest peaks. The cold gradually increased; the wind became steady; and the moon lighted me like the sun. I was at the foot of the Alps; the snows, cascades, rivers, all were sparkling; the ravines and rocks produced masses of darkness which served as shadows to the gigantic picture. The wind now interrupted the regularity of my course; I was occasionally obliged to ascend, in order to pass over the peaks. I reached the summit of the Alps at eleven o'clock; and as the horizon became clear, and my course regular, I began to think of supping. I was now at an elevation of 4600 metres. It was indispensably necessary for me to pursue my journey and reach Piedmont. Chaos only was under me; and to alight in these regions was impossible. After supper I threw my empty bottle into the snow beneath, where possibly some adventurous traveller will one day find it, and will be led to conclude that another before him had explored the same desert regions.

"At half-past one in the morning I was over Mont Viso, which I knew, having explored it in my first journey to Piedmont. There the Durance and the Po take their source. I reconnoitred their position, and discovered the magnificent plains of the mountain. Before this certainty a singular optical delusion, occasioned by the shining of the moon upon the snow, made me at first think myself over the open sea. But as the south-west wind had not ceased to blow, I was convinced by this fact, as well as by others I had noticed, that I could not be over the sea. The stars confirmed the accuracy of my compass; and the appearance of Mont Blanc satisfied me that I must be approaching Turin. Mont Blanc to my left, on a level with the top of which I was, being far above the clouds, resembled an immense block of crystal, sparkling with a thousand fires.

"At a quarter to three Mont Viso, which was behind me, proved to me that I was in the neighbourhood of Turin. I determined to alight, which I did without much difficulty, having ballast enough to go much farther. I alighted near a large farmyard, where I was surrounded by several watchdogs, from whose caresses I was protected by my cloak. Their barking awakened the peasants, who were more surprised than frightened at seeing me. They admitted me to their house; informed me that it was half-past two, and that I was in the village of Pion Forte, near Stubini, six kilometres from Turin. I passed the remainder of the night in the farmhouse; and in the morning the peasants accompanied me to the mayor, who delivered me a certificate, attesting my arrival, &c. After packing up my balloon and car, I set out for Turin, where I arrived at nine in the morning."

In this voyage the aeronaut sailed from west to east, from Marseilles to Nice, a distance of about a hundred miles. Crossing the mountains at a point where the Cottian Alps meet and form an angle with the Maritime Alps, he was swept along their eastern side in nearly a northern direction. Had he ascended higher he would no doubt have been carried towards Genoa.

1850.—Mr. Bell attempted an improvement in the form of the balloon, which he

endeavoured to propel by means of screws and fans. Mr. Poitevin attracted 150,000 people in Paris, to look at an exhibition of himself ascending on horseback. Mr. Gale met with his death at Bordeaux during an ascent; for, as was sometimes the case with him, intoxicating liquors robbed him of the full use of his faculties, which are more than ever essential on such extraordinary occasions.

1851.—An accident that befell Mr. and Mrs. Graham, attracted particular attention, from occurring in the metropolis. After grazing the Great Exhibition building, the balloon did some damage to Colonel North's house. The following is Mrs. Graham's account, whilst still suffering from the effects of the ascent:—

SIR, Walworth, June 17, 1851.

May I beg to forward you as correct an account as possible respecting the ascent of the balloon from the Hippodrome yesterday? It is well known that the wind blew almost a hurricane at times during the day; so much so that, whilst the inflation was proceeding, upwards of thirty men, who were holding on, were constantly blown to various parts of the circle by the power of the wind on the balloon. At such times it is totally impossible to ascertain the buoyant power at the time of starting by the usual method of weighing. When we arose the wind carried us against a high mast or pole in the ground, before we had time to cast out ballast, and a long rent was caused in the upper part of the balloon. We cast out sand to clear the trees in Kensington Gardens, and finding ourselves approaching the Crystal Palace, we gradually discharged the ballast with our hands, so that no great weight should fall in any one spot. We succeeded in quite clearing it, and then made for a descent in the park, which we effected on the grass, and threw out the long line of our safety-bag (without anything being attached) to some men who were running. Two of them caught this line, and held on for some time, but being dragged along by the force of the wind they let go, and we directly rebounded, the wind carrying us on to a house in Arlington Street, and from thence to one in Park Place, where the car rested between a stack of chimneys and a roof, where we remained until some policemen of the C division and some gentlemen's servants came to our assistance, and aided us with ladders to descend through a trap-door, when two eminent medical gentlemen of the neighbourhood promptly attended, and rendered us the most kindly aid professionally at such a trying moment. Allow me to add that the grappel-iron we never let from the car, as can be proved by those who assisted us on the roof, it never having been untied from the side of the car, as we were too anxious to prevent any accident occurring to the men who were running after us. Neither did we touch any part of the Crystal Palace. With regard to any accidents that have occurred to myself in my numerous ascents, I have only confidently to declare that I have met with no more than the most experienced aeronaut of the day—all being liable to mischances, particularly on such a boisterous day as yesterday.

M. GRAHAM.

1852.—Mr. Coxwell returned to England, where he met with a hearty welcome. A scientific balloon ascent was made this year by Mr. John Welsh, of the Kew Observatory. Henry Mayhew gives the following account of his experience of an ascent:—

"IN THE CLOUDS;" OR, SOME ACCOUNT OF A BALLOON TRIP WITH MR. GREEN.

I am naturally a coward—constitutionally and habitually timid—I do not hesitate to confess it. The literary temperament and sedentary pursuits are, I believe, seldom associated with physical courage. Fear, or the ideal presence of prospective injury, is necessarily an act of the imagination; and the sense of danger, therefore, closely connected with a sense of the beautiful and the æsthetic faculties in general. Your human bulldogs are mostly deficient in mental refinement, and perhaps if there be no class of characters more fancyless than the rest of the world, they are those who are said to belong to the "*fancy*." My creed is that all imaginative men are cowards; and that I am one I have at least moral courage and honesty enough to acknowledge.

Then why go up in a balloon?

Yes, why? These are times when men's principles of action are sure to be canvassed; so, to prevent the imputation of any false motives, I will make a clean breast of it, and confess that it was merely "idle curiosity," as the world calls it, that took me into the air.

I had seen the great metropolis under almost every aspect. I had dived into holes and corners hidden from the honest and well-to-do-portion of the Cockney community. I had visited Jacob's Island (the plague-spot) in the height of the cholera, when, to inhale the very air of the place was almost to breathe the breath of death. I had sought out the haunts of beggars and thieves, and passed hours communing with them as to their histories, habits, natures, and impulses. I had seen the world of London below the surface, as it were, and I had a craving to contemplate it far above it—to behold the immense mass of vice and avarice and cunning, of noble aspirations and humble heroism, blent into one black spot; to take, as it were, an angel's view of that huge city where, perhaps, there is more virtue and more iniquity, more wealth and more want huddled together in one vast heap than in any other part of the earth; to look down upon the strange, incongruous clump of palaces and workhouses; of factory chimneys and church steeples, of banks and prisons, of docks and hospitals, of parks and squares, of courts and alleys—to look down upon these as the birds of the air look down upon them, and see the whole dwindle into a heap of rubbish on the green sward, a human anthill, as it were; to hear the hubbub of the restless sea of life below, and hear it like the ocean in a shell, whispering to you of the incessant strugglings and chafings of the distant tide—to swing in the air far above all the petty jealousies and heartburnings, and small ambitions and vain parades, and feel for once tranquil as a babe in a cot—that you were hardly of the earth, earthy; and to find, as you drink in the pure thin air above you, the blood dancing and tingling joyously through your veins, and your whole spirit becoming etherealised as, Jacob-like, you mounted the aerial ladder, and beheld the world beneath you fade and fade from your sight like a mirage in the desert; to feel yourself really, as you had ideally in your dreams, floating through the endless realms of space, sailing among the stars free as "the lark at heaven's gate;" and to enjoy for a brief half-hour at least a foretaste of that elysian destiny which is the hope of all. To see, to think, and to feel thus was surely worth some little risk, and this it was that led me to peril my bones in the car of a balloon.

It is true that the aerial bulls and ponies of late had taken nearly all poetry from the skies, reducing the ancient myths to the mere stage trikceries of an ethereal Astley's; true that the depraved rage for excitement—that species of mental dram-drinking which ever demands some brutal stimulant—had given a most vulgar, prosaic character to a voyage which, when stripped of its peril, is perhaps one of the purest and most dignified delights that the mind is capable of enjoying; still, quickened with a love of my own art, and heedless of any silly inputations of rivalry with quadrupeds and mountebanks, I gladly availed myself of a seat in the car which Mr. Green had set aside for me.

At about a quarter to seven o'clock, six of us and the "veteran aeronaut" took our places in the large deep wicker-work basket of a car attached to the Royal Nassau Balloon, while two gentlemen were seated immediately above our heads, with their backs resting against the netting and their legs stretched across the hoop to which the cords of the network are fastened, and from which depends the car. There were altogether nine of us—a complete set of human pins for the air to play at skittles with—and the majority, myself among the number, no sylphs in weight. Above us reeled the great gas-bag like a monster peg-top, and all around the car were groups of men holding to the sides of the basket, while the huge iron weights were handed out and replaced by large squabby bags of sand.

In the course of about ten minutes all the arrangements for starting were complete; the grapnel, looking like a bundle of large iron fish-hooks, welded together, was hanging over the side of the car. The guide-rope, longer than St. Paul's is high, and done up in a canvas bag, with only the end hanging out, was dangling beside the grapnel, and we were raised some fifty feet in the air to try the ascensive power of the machine that was to bear us through the clouds. Then, having been duly dragged down, the signal was at length given to fire the cannons, and Mr. Green loosening the only rope that bound us to the Gardens, we shot into the air—or rather the earth seemed to sink suddenly down, as if the spot of ground, with all the spectators on it, and on which we ourselves had been lately standing, had been constructed on the same principle as the Adelphi stage, and admitted of being lowered at a moment's notice. The last thing that I remember to have seen distinctly was the flash of the guns, and instantaneously there appeared a multitude of upturned faces in the Gardens below, the greater part with their mouths wide open, and a *chevaux-de-frise* of hands extended above them, all signalling farewell to us.

Then, as we swept rapidly above the trees, I could see the roadway immediately outside the Gardens, stuck all over with rows of tiny people, looking like so many black pins on a cushion, and the hubbub of the voices below was like the sound of a distant school let loose.

And here began that peculiar panoramic effect which is the distinguishing feature of a view from a balloon, and which arises from the utter absence of all sense of motion in the machine itself. The earth appeared literally to consist of a long series of scenes, which were being continually drawn along under you, as if it were a diorama beheld flat upon the ground, and gave one almost the notion that the world was an endless landscape stretched upon rollers, which some invisible sprites were revolving for your especial enjoyment.

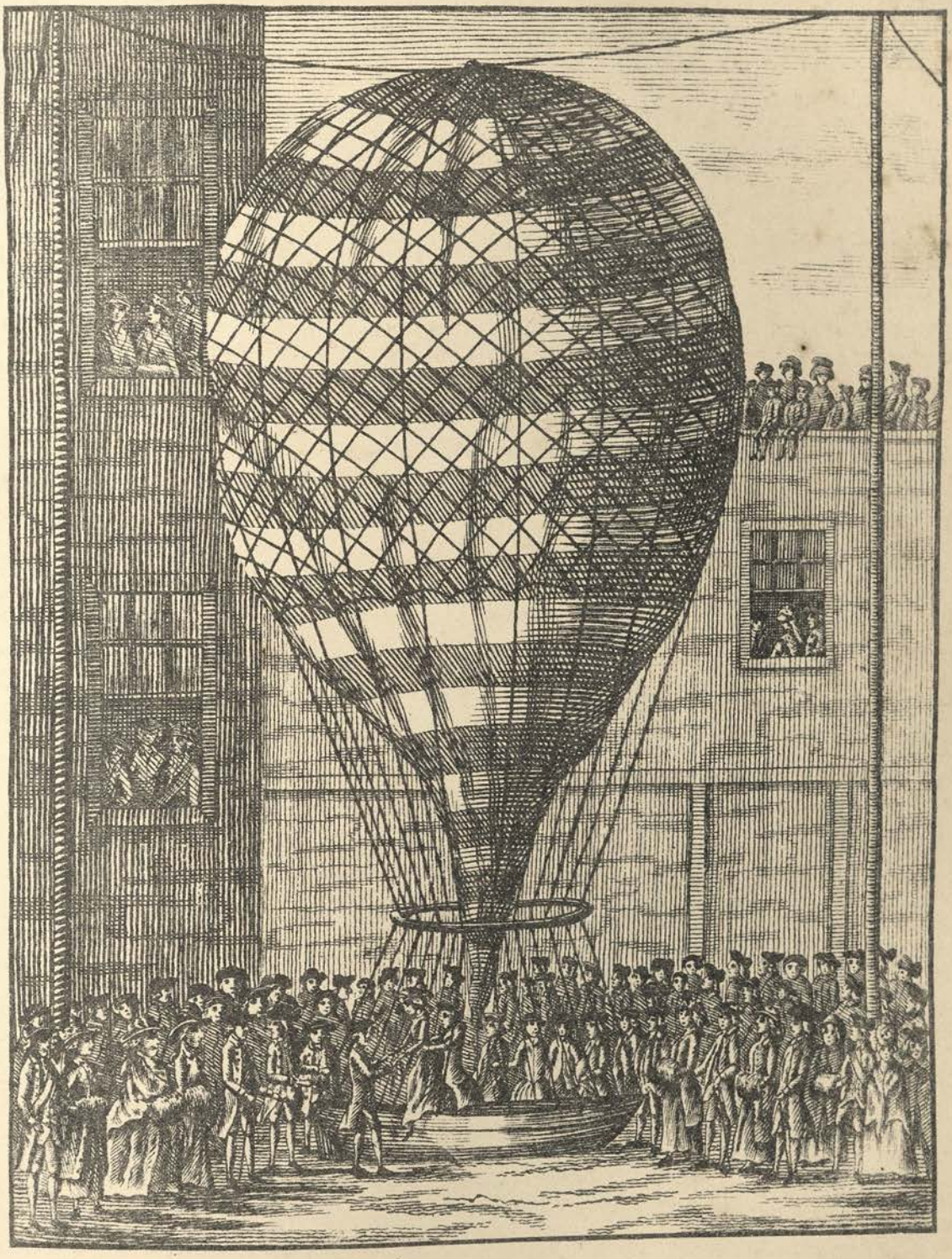
Then, as we struck towards the fields of Surrey, and I looked over the edge of the car in which I was standing, holding on tight to the thick rope descending from the hoop above, and with the rim of the wicker-work reaching up to my breast, the sight was the most exquisite delight I ever experienced. The houses below looked like the tiny wooden things out of a child's box of toys, and the streets like ruts. To peer straight down gave you an awful sense of the height to which the balloon had already risen, and yet there was no idea of danger, for the mind was too much occupied with the grandeur and novelty of the scene all around to feel the least alarm. As the balloon kept on ascending, the lines of buildings grew smaller and smaller, till in a few minutes the projections seemed very much like the prominences on the little coloured plaster-models of countries. Then we could see the gas-lights along the different lines of road start into light one after another all over the earth, and presently the ground seemed to be covered with little miniature illumination lamps, such as may be seen resting on the grass at the edge of the gravel walks in suburban gardens of amusement. The river we could see winding far away, undulating, as it streamed along, like a man-of-war's pennant, and glittering here and there in the dusk like grey steel. All round the horizon were thick slate-coloured clouds, edged with the orange-red of the departed sun; and with the tops of these we seemed to be on a level. So deep was the dusk in the distance, that it was difficult to tell where the earth ended and the sky began; and in trying to make out the objects afar off, it seemed to be as if you were looking through so much crape. The roads below were now like narrow light-brown ribbons, and the bridges across the Thames almost like planks; while the tiny black barges, as they floated up the river, appeared no bigger than insects. The large green fields had dwindled down to about the size of kettle-holders, and the hedges were like strips of *chenille*.

When we were about a mile above the ground some of us threw pieces of paper into the grey air, and these, as we rose and left them below, fluttered about like butterflies as they fell. Then some of the more noisy of the crew struck a song; while I heard a dyspeptic gentleman immediately behind me, as I was kneeling down (for there was but one seat), and stretching my head over the side of the car, contemplating the world of wonder below, confess to feeling a little nervous; saying that he was a man of natural moral courage, but his body overcame it, as he was subject to fits of indigestion, and as a preventive to extreme nervousness had taken nothing but vegetables for dinner that day. And I must confess myself that, poised up high in the air, as we were, with but a few slender cords to support us, I could not help thinking of the awful havoc there would be if the twigs of the wicker car were to break and the bottom give way.

On what sharp church-steeple, thought I, should I be spitted? and as I looked down the beauty of the scene once more took all sense of fear from my mind, for the earth now appeared concave with the height, and seemed like a huge black bowl—as if it were the sky of the nether regions. The lights of the villages scattered over the scene were like clusters of glowworms, from the midst of which you could here and there distinguish the crimson speck of some railway-lamp.

"There, I've thrown over a letter, directed to my house," said one of the passengers, "telling 'em we're all safe up here"—and as I stretched over the car I saw the little white fluttering thing go zigzagging down the air while we still mounted the sky.

Then some of the passengers, who had supplied themselves with an extraordinary stock of courage previous to starting, by means of sundry bottles of "sparkling champagne," which had the effect of making them more noisy than agreeable in such a situation, must needs begin quarrelling with a rose-water Captain in the hoop, as to whether they belonged to the "Snobocracy" or the "Nobocracy," and at one time their words were literally so high that, could the pair have got to close quarters, the dispute would certainly have assumed a more serious character; for, jammed tight together as we were in the car, the least attempt at violence would certainly have ended in discharging the whole human cargo into the railway-station below. But as it was, it certainly did



COUNT ZAMBECCARI's BALLOON

*Which was to have taken up* Himself, *Rear-Admiral* Sir Edward Vernon Kn^t *and* Miss Grice *from Tottenham Court Road, but not having time to fill the Balloon sufficiently Miss Grice was obliged to get out - after this it ascended with Sir Edward and the Count about 4 o Clock and descended near Horsham in Sussex 36 Miles distant in one Hour March 23^d 1785*

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt^n H. Heldsham James R.E. Col. Sir H. James R.E. F.R.S. &c. Director.*

1864

appear most ludicrous that two rational beings must choose that place of all others for engaging in some paltry squabble as to the vulgar division of the human family into "Nobs" and "Snobs."

Silence, however, was soon restored by Mr. Green reminding the disputants that we were descending at a rapid rate, and it was time they began to look out for their safety.

The dyspeptic passenger, who during the dispute had evidently been suffering from another attack of nervousness, was at length terrified beyond human endurance by the gentleman who was rather the worse for champagne indulging in even warmer language than he had yet given vent to.

"For mercy sake don't swear up here, my good man!" shivered out the poor invalid. "Wait till you get down below, if you must swear. We are always in the hands of Providence; but, up here, it strikes me that our lives are literally hanging by a thread."

The collapsing of the bottom part of the balloon, to which Mr. Green here drew our attention as evidence of the rate at which we were descending, soon restored order, and made every one anxious to attend to the directions of the aeronaut. We could now hear the sounds of "Ah bal-loon!" again rising from the ground and following in our wake, telling us that at the small villages on our way the people were anxiously looking for our descent. A bag of ballast was intrusted to one of the passengers to let fall at a given signal, while Green himself stood with the grapnel ready to loose immediately he came to a fitting spot. Presently the signal for the descent of the ballast was given, and as it dropped it was curious to watch it fall; the earth had seemed almost at our feet as the car swept over the fields, but so long was the heavy bag in getting to the ground that, as the eye watched it fall and fall, the mind was filled with amazement at the height the balloon still was in the air. Suddenly the sound as of a gun announced that the bag had struck the soil, and then we were told all to sit low down in the car and hold fast. Scarcely had we obeyed the orders given than the car was suddenly and fiercely jerked half round, and all within it thrown one on top of another; immediately after this, bump went the bottom of the car on the ground, giving us so violent a shake that it seemed as if every limb in the body had been simultaneously dislocated. Now the balloon pitched on to its side, and lay on the ground struggling with the wind, and rolling about, heaving like a huge whale in the agonies of death.

"For Heaven's sake! hold fast," shouted Mr. Green, as we were dashed up and down in the car, all rolling one on the other, with each fresh lurch of the giant machine stretched on the ground before us, and from which we could hear the gas roaring from the valve, like the blast of a furnace.

"Sit still, all of you, I say!" roared our pilot, as he saw some one endeavouring to leave the car.

Again we were pitched right on end, and the bottom of the car shifted into a ditch, the water of which bubbled up through the wicker-work of the car; and I, unlucky wight, who was seated in that part to which the concussions were mostly confined, soon began to feel that I was quietly sitting in a pool of water.

To move, however, was evidently to peril not only one's own life, but that of all the other passengers, but still no one came to us; for we had fallen in a swamp, which we afterwards found out was Pirbright Common, situate some half-dozen miles from Guildford.

Presently, however, to our great delight, some hundred drab-smocked countrymen appeared, almost as if by magic, around the edges of the car; for some little time they were afraid to touch, but at last they got a firm hold of it, and we were one after another extricated from our seats.

To tell the remainder of the adventure would be tame and dull: suffice it, after some two hours' labour, the aerial machine, car, grapnels, and all, was rolled and packed up in a cart, and thus transported, an hour after midnight, to Guildford; the voyagers journeying to the same town in a tilted cart, delighted with their trip, and listening to the many curious adventures of the veteran aeronaut who had successfully piloted them and some hundred others through the air; and who, now that the responsibility of their lives rested no longer in his hands, seemed a thoroughly different man: before he was taciturn, and almost irritable when spoken to; and now he was garrulous, and delighting all with his intelligence, his enterprise, his enthusiasm, and his courtesy. Indeed, long shall we all remember the pleasant night we passed with the old ethereal pilot on his 500th ascent with the Royal Nassau Balloon.

1853.—In this year Mr. Knight made an ascent, and tried experiments, at Bombay.

1854.—A pamphlet appeared, containing an imaginary conversation between an aeronaut and a general, written with much spirit and humour, by Mr. Coxwell, who hoped

that balloons might be used in the Crimea. Several of his letters appeared also in the 'Times.'

1857.—On Monday, June 15, Mr. Coxwell made an extraordinary balloon voyage of 250 miles in five hours.

This extraordinary voyage, which is perhaps unprecedented for speed and distance combined, commenced from the Pavilion Gardens, North Woolwich, and terminated about three miles beyond Tavistock, in Devonshire, just on the borders of Cornwall. A day ascent was announced from these beautiful gardens, but the strong wind which blew prevented the inflation until a late hour. Mr. Coxwell, sooner than allow the visitors to be disappointed, volunteered to make a night ascent; and at half-past eleven o'clock the aeronaut took his seat in the car, and invited Mr. J. Allan, of Wellclose Square, and Mr. Youens of Poplar, to accompany him. The balloon at this moment presented a magnificent spectacle, as it was surrounded by coloured fires; and it immediately afterwards took flight amidst huzzas and a salvo of garden artillery. The voyagers traversed the southern portion of the metropolis, and the view of London by night was most wonderful and beautiful, and by means of the gas-lights every bridge and main street could be traced. They crossed directly over Richmond, where the aeronauts came to a consultation on the propriety of a descent, but agreed to make a night of it. At twelve the aeronauts were over Windsor, where they drank the health of Her Majesty and sung "God save the Queen," in the most novel and exciting situation it is possible to imagine.

About one A.M., the famous aerial captain instituted as careful a survey as possible of the country beneath. The moon, which had now risen, assisted the search. The well-known sound of the waves on the sea-shore soon caught the aeronautic ear; but Mr. Coxwell expressed a belief that although the balloon was approaching the coast, it was only in a skirting direction—and such appeared to be the fact, as it was afterwards ascertained that they were over Hampshire. As daylight broke, the calculations were found to be correct, the intrepid party finding themselves hugging the coast, and going along at considerable speed. The river Exe was crossed over Starcross Station, between Exeter and Exmouth, when the sun just appeared, and the voyagers simultaneously exclaimed, "See 'the rosy morn tips the hills with gold,'" as in appearance it did; it was beautiful in the extreme, and never to be forgotten. Dartmoor was traversed, when Mr. Coxwell determined to avail himself of the shelter afforded by the hills, and descended in a valley, about three miles from Tavistock, where a suitable meadow presented a good landing-place.

It was some time before the particulars of the journey obtained credence. At Sidmouth the alarm-bell was rung by the night watchman; but before the inhabitants were astir the balloon was out of sight, and the man laughed at, until the Devonshire papers were published with an account of the voyage. At Newton Abbot the balloon was declared to be the comet; but the railway-guard stopped the panic, by declaring the aerial visitor to be Mr. Coxwell's balloon. The aeronauts walked to Tavistock, and put up at the Queen's Hotel, where they had some difficulty in persuading the worthy host, Mr. Northway, that they were in London the night before. After partaking of a hearty breakfast, the balloon was brought into the town, amidst the cheers and congratulations of the major part of the inhabitants.

## Exploration of Australia by Balloons.

1858.—The following letter appeared in the 'Times' of January 23:—

Sir,

A short time since a paragraph appeared in 'The Times,' to the effect that it was "gravely proposed in Victoria to explore the interior of that country through the agency of balloons."

As I am the aeronautic designer and constructor of the balloons which were ordered in this country by the Honourable George Coppin for use in Australia, it may not be uninteresting to state how far the rumour of an aerial voyage is correct, and in what way a survey is contemplated of apparently so hazardous a nature.

Firstly. The balloons which are now at Melbourne were never built for the purpose of scientific experiment or exploration, but simply for public amusement. The aeronauts, however, who went out in accordance with my recommendation, were particularly requested to make frequent meteorological observations, both in the higher region and lower currents, especially with a view of observing how far it is likely a balloon would be influenced

by inland and return breezes. Mr. C. H. Brown, a gentleman of acute observation, assisted by Mr. Dean, are now making the necessary inquiries, and from the accounts already received, there appears to be good grounds for believing that certain reliable currents will facilitate the undertaking. As a matter of course, expressly built machines, of ample dimensions, will be requisite, together with every conceivable appliance, to afford a return journey by a diametrically opposite wind to that embraced at the outset. The party will also be provided with an improved and gigantic fire-balloon, in a collapsed state, which can be inflated in the most desolate interior locality without gas; a reserve expedient, which, in the event of injury or exhaustion to the parent machine, will provide the means for a second trip.

I am also maturing a totally novel apparatus, calculated to regulate the altitude of the exploring balloon, so as to avoid the continual loss of gas and power resulting from extreme variations in the atmosphere; and I trust that this contrivance will bring the aerial vehicle under a larger amount of mechanical control, and thereby prove a step in advance towards real utility.

The expedition will be provided with a photographic apparatus to stamp, with truthful and indelible outlines, a series of bird's-eye views, the indisputable correctness of which will be invaluable, with written records of passing scenes. Viewing calmly the danger likely to accompany such an attempt, I do not think it can fairly be pronounced greater than that which attends an Arctic voyage, or any other which originates from a desire to attain useful knowledge by intrepidity and personal risk.

This may be the language of enthusiasm, for which the more sober portion of mankind feel no sympathy and offer no encouragement. The voyage, however, will not depend upon the public voice to order the liberating iron to be pulled, but upon the inspiriting motive-power resulting from careful calculations, in which the odds, coupled with the promised advantages, are in favour of the trial.

I remain, Sir, your obedient servant,

Tottenham, Jan. 22. HENRY COXWELL.

(*From the 'Aerostatic Magazine.'*)

The following is a brief outline of my plan, which is, no doubt, susceptible of improvement. Operation the first must be the building of a large shed, somewhat resembling the covering to the ships in our dock-yards, where the balloons could be constructed, inflated, and protected from the weather. I would prefer two distinct balloons to one leviathan air-ship, as, to a certain extent, the balloons might be made serviceable, the one to the other, and in the event of an imperfection or rupture in one, the other might be resorted to; and this would be rendered practicable, as the two would be connected by a spar, although distinct in their position and floatage. The size of these balloons I estimate at 100 feet in diameter, which would give, calculating for the globular form, a surface of 31,416 square feet each balloon, and a capacity of 523,599 *cubic feet*. Thus do these few figures clearly show the advantage of ample dimensions, as the yards of silk required are infinitely less in proportion to the capacity, than is the case with ordinary-sized balloons, because the surfaces of spheres are as the squares of the diameter, whilst the contents are as the *cubes*. Over two-thirds of the exploring balloons, outside and free from the netting, I would employ a hood or overcoat of silk, so as to keep off rain or humidity from the gas-bag itself, the effects of moisture producing disagreeable consequences, both to the voyagers and to the balloon. As the power of tolerably good-burning gas of the specified quantity would raise more than 40,000 pounds weight, the machines could take every available requisite, with four persons in each car, and two horses in separate cars slung underneath. If pure hydrogen were used, the power would be greatly increased; but, all things considered, I should prefer coal-gas generated expressly, at a specific gravity of about 350.

It would be well to have the cars waterproof, something after the fashion of a seaport-car I invented some years since, which was so constructed to act as a lifeboat in case of being driven out to sea.

Supposing the balloons to be fully equipped, and the wind in the desired point, two courses would be open to the commanding aeronaut; either a bold, reckless dash for the interior, leaving it to chance, or a return breeze, to get back; or else a mode of procedure based upon reasonable inferences, by which the course of the balloon could be traced, and by which the aerial party could steer their way back. This latter is the plan I should advise, "discretion being the better part of valour."

After inflating the balloons, it would be advisable to connect them by means of a wooden or iron rod, say 150 feet across, made in pieces like a fishing-rod. Ropes on either side would form an additional security, and

a special foot-rope would prove instrumental for a personal transfer, if needed, in the manner seamen travel the yards on board a man-of-war.

'Secondly. Trail-ropes, to restrict the altitude to about 500 feet, not being objectionable in an uninhabited country, would prove immensely serviceable. Indeed, without some means of confining the balloon to a limited altitude, either by machinery to cause a succession of ascents and descents, or by trail-ropes, the horizontal course of the balloons would be limited, probably, to twenty-four hours' duration; the variation, both in temperature and in atmospheric pressure on the surface of the balloons, would otherwise occasion a continued exhaustion of gas; whereas, by connecting the machine with the earth's surface, the loss of power and increase of weight at night, or during rain, would be counterbalanced by an increased deposit of rope to drag; and subsequent expansion by heat would restore the balance, leaving it to disposable power or ballast to settle the difference.

Thirdly. The most important provision of all remains to be considered, viz., how to leave behind, from the very place of starting, sure indication of the course pursued, so that the aerial party might steer homeward by, in case they could keep afloat no longer, or a searching party might be directed by, if called upon to look for the aeronautic expedition.

It appears to me that the simplest and most effectual way to accomplish this would be as follows:—

To be provided with an abundant stock of paper messengers containing the printed words, "*The Balloon Way.*" At stated intervals of time, say every half-minute, it would be the duty of the Watch to cast out these bills, which would soon reach the ground, and would serve as a clue to the course taken. Then, again, at spaces of about ten or twenty miles, a flag and staff might be let down with a waterproof bag of corn and provisions near the pointed extremity, which would cause it to fall straight and enter the soil; the flag would prove a landmark, and the provisions might accommodate either horses or wayfarers out or home.

By taking ballast of corn and hay, besides sand, and discharging it in bags, the balloon would be relieved when requisite, and numerous places of refreshment established, with signposts to denote them.

As the country is described to us as "thickly wooded, and abounding with good natural pasturage," the aeronauts could plant their landmarks on high open ground, and as an india-rubber covering would shield the provisions from rain, so would it, perhaps, from the interference of animals in search of food. A wire cage would be a useful addition.

In the pioneer trip it would be advisable not to penetrate too far, but rather to return with good tidings, and photographic views.

As we are led to suspect the existence of plains and open localities, the balloons could be brought up and moored if desirable, until the wind chopped round, as indicated by the compass, for the homeward voyage.

The immense capacity of balloons one hundred feet in diameter, just constructed of thick new silk, would enable the aeronauts to anchor them in shady spots without experiencing any considerable loss of power. I am at the present time giving attention to a contrivance to supersede, in some measure, the use of the trail-ropes, or, at any rate, to prevent any unpleasant results in case of these ropes breaking. The possibility of suddenly parting with a great weight, calls for counteracting machinery, and I trust I have hit upon a plan by which the upward flight of the balloons would be checked.

If the worst happened, the horses must be mounted and baited occasionally at the sign of the flagstaff. The bills would point out the route.

Here, then, is a short sketch, in which the probable dangers and emergencies are considered and provided against.

## Ballooning in Australia.

(*From the 'Aerostatic Magazine.'*)

This year will ever be memorable in Melbourne and Sydney for the first introduction of ballooning by Messrs. Brown and Dean, the Aeronauts from London. The Honourable George Coppin conceived the idea of attracting public attention to them at Cremorne Gardens, and a goodly number of ascents, both by day and by night, have taken place with great éclat. The following accounts from Australian papers will be read with interest:—

"We have to acknowledge our obligations to the aeronauts for the following narrative of last night's voyage

in the air:—'Our ascent yesterday evening from Cremorne Gardens with the "Australian" Balloon, was the most pleasing we ever made, and terminated in a manner never before accomplished by any aeronaut. We ascended at five minutes past ten, with a considerable apparatus of fireworks suspended from the car, which the calm state of the evening enabled us to display over the heads of our patrons in Cremorne. We hovered over the gardens for a considerable length of time, and then moved off towards the Botanical Gardens, over which we were at twenty-three minutes past ten. After following for some time the meanderings of the river Yarra, we met with a decided current which carried us over Richmond Paddock, but at a very slow rate. Twice we descended, and conversed with the people below, who were very pressing in their solicitations for us to descend; but, as there were great numbers of them, we were afraid the balloon would be injured, and resolved to continue our course, so as to descend on the opposite side of the Yarrow, somewhere near Battam's Swamp. Our greatest altitude was about a mile and a half. At that height the air was quite warm, and we were obliged to lay aside our greatcoats.

The deposition of moisture on the balloon and netting was so great as to oblige us almost continually to throw out ballast. The booming of the firework signal-gun at Cremorne was distinctly heard by us, and the fireworks presented one of the grandest sights imaginable. The moon shone so bright that we could see our compass and watch, and even read a newspaper we had with us as well as at noonday. After passing over the railway we let out gas and came down gently near the gasworks at Battam's Swamp, among a large crowd; but as some persons in the crowd behaved rather rudely, breaking some of the apparatus and shaking the car violently, we threw out ballast, and they in vain endeavoured to retain the balloon, which reascended to an elevation of 1500 feet. In reascending, a current brought us back over the railway, and we finally came down at five minutes past eleven, between Emerald Hill and the railway. The balloon was immediately surrounded by hundreds of people, some of whom seemed determined to have us conveyed to Emerald Hill, contrary to our desire. A gentleman in the crowd called out with a loud voice, 'Gentlemen, remember Collingwood—don't disgrace Emerald Hill.' This had the effect we desired, and when our wish to return to Cremorne Gardens was made known four soldiers and some other parties towed the inflated balloon, with us seated in the car, over Prince's Bridge, along the Richmond and Punt Roads, through Swan Street and Cremorne Street, and deposited us at twelve o'clock on the identical spot from whence we had ascended amidst immense cheering."—'*Melbourne Evening Mail*,' *March* 30, 1858.

*The Balloon Ascent in the Domain.*

The large and splendid balloon which, under the name of "the Australasian," has already made numerous successful ascents in Melbourne, rose, with Messrs. Brown and Dean in its car, from the Cricket Ground in the Outer Domain, yesterday afternoon, at five o'clock. A very large concourse of people—amounting to upwards of 7000 persons, attracted by the great novelty of the thing—were present on the occasion, and hailed the entire success of the undertaking with shouts of pleasure and approbation. The weather had been during the day of a somewhat unpropitious character, and the wind (which blew pretty smartly from the southward) was considered by many to be in every way unfavourable to the enterprise. In spite, however, of every sinister prediction, the first balloon ascent in New South Wales was happily accomplished.

The tedious and difficult process of inflation took place in an open space nearly opposite the Government Offices, not far from the gate of the Inner Domain. It was skilfully managed with gas laid on from one of the mains of the Australian Gaslight Company, and commenced at about two o'clock, in the presence of numerous spectators. After having been continued for about two hours, during which the enormous monster absorbed between 30,000 and 40,000 feet of gas, the "Australasian," beginning to oscillate somewhat considerably from the effects of the wind, was carefully escorted by a numerous and eager number of volunteers to the arena prepared for the display of its powers. To avoid the difficulties inseparable from the road, the balloon was brought by a short cut across the western corner of the Government Paddock, about one hundred yards below Sir Richard Bourke's Statue, into the Outer Domain, where it was temporarily moored safely enough a few minutes after four o'clock. About a half-hour afterwards a salute of four guns, fired from a six-pounder by some of the corps of the Royal Artillery, announced the arrival of his Excellency the Governor-General and suite, who were conducted to a handsome tent, decorated with flags, and standing within the spacious enclosure. Some apprehension was now excited on account of the wind, and, although held down and kept steady as far as possible, the "Australasian" swayed about a good deal. His Excellency himself left the tent provided for him, and, having honoured the balloon with a close and personal inspection, concurred in the opinion of some other persons of

high scientific attainments, that the inflation was quite sufficient. After a short delay, everything was promptly cast off, and the balloon at once rose steadily and majestically from the spot amidst loud and general cheering. Although the wind was rather strong, not the slightest oscillation was perceptible. The aeronauts responded to the greetings of the crowd by waving their caps, throwing out bills, &c., becoming rapidly less and less distinctly visible as the balloon took a northerly direction. Having reached a considerable altitude, the balloon crossed the harbour; and, after the lapse of a few minutes, was observed to be slowly descending near the gulley, Neutral Bay, a short distance from Mr. Severn's residence.—'*Sydney Morning Herald*,' *Dec.* 14, 1858.

1859.—The Crystal Palace Company engaged Mr. Coxwell's services for ascents from their gardens.

1861.—Depuis Delcourt thus wrote to Dr. Pierre Moreaud, to encourage him in the successful experiments he was making with regard to the application of steam to captive balloons:—

SIR, Paris, March 2nd, 1861.

I thank you for writing, and I urge you to carry out your project of publishing a *resumé*, or rather an exposition of your system.

Whilst waiting for the successful issue of aeronautics, when the fields of air will be traversed with freedom, you may demonstrate what can be actually done with aerostation even in its present state.

Your method of directing captive aerostats appears to be without a flaw; that is something! Their construction will assist general locomotion.

By experiments made on a larger scale than those already attempted you will force the *savans* not yet convinced to come and discuss the subject with you. Let the public also have knowledge of it: capitalists will appreciate the resources of your system; and when the day shall have arrived for the final experiment they will not fail to supply you with the funds.

The idea expressed sixty years ago by Thilorier will at length be put in practice. His reasoning was just; but at that time they had neither steam, electric telegraph, nor many of the other resources of which you intend to make so judicious a use. The means of application and the realisation incontestably belong to you.

As to me, Sir, who for many years have sacrificed much to the art of aerostation, I shall be happy if my personal assistance can be of use in the work you have so courageously undertaken.

The best commencement, as I have already told you, will be to make the first regular transport by the aerial line from *Paris to St. Cloud*. Napoleon III. likes great undertakings, and protects them as an enlightened man and powerful monarch, as soon as they are brought to his knowledge.

Your idea, in thus rendering homage to him, would be placed to a certain extent under his patronage.

Publish your book, Sir, and by this means aid the spread and development of the aerostatic question.

Accept at all times my devoted services.

Your obedient servant,

DEPUIS DELCOURT.

1862.—At the meeting of the British Association, a Committee was formed for the purpose of determining the temperature and hygrometric condition of the air at different elevations above the earth's surface. It consisted of—

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| Colonel Sykes. | Lord Wrottesley. | Dr. Robinson. |
| Professor Airy | Sir J. Herschel. | Mr. Gassiot. |
| Sir D. Brewster. | Dr. Lloyd. | Mr. Glaisher. |
| Admiral Fitzroy. | Dr. Lee. | Dr. Tyndall. |
| Mr. Fairbairn. | Dr. W. A. Miller. | |

They secured the services of Mr. Coxwell; but, not having sufficient funds for the construction of a balloon of a suitable size, this aeronaut, with true professional zeal and

liberality, declared his readiness to construct the required machine entirely from his own resources. It was completed by June; and then commenced the scientific ascents of Messrs. Glaisher and Coxwell, which have become so memorable. The following is Mr. Glaisher's account, published by the request of the Committee, for the eight ascents in 1862, extracted from the 'Report of the British Association.' There is in addition a mass of figures, of which I give only those for the highest ascent, on September 5, from Wolverhampton, when these enterprising aeronauts attained the unprecedented elevation of *seven miles*.

§ 1. Objects of the Experiments.

The *primary* objects were—

The determination of the temperature of the air, and its hygrometrical states, at different elevations, as high as possible.

The *secondary* objects were—

To determine the temperature of the dew-point by Daniell's dew-point hygrometer, by Regnault's condensing hygrometer, and by dry- and wet-bulb thermometers as ordinarily used, as well as when under the influence of the aspirator; so that considerable volumes of air were made to pass over both their bulbs, at different elevations, as high as possible, but particularly up to those heights where man may be resident, or where troops may be located, as in the high lands and plains in India, with the view of ascertaining what confidence may be placed in the use of the dry- and wet-bulb thermometers at those elevations, by comparison with the results as found from them, and with those found directly by Daniell's and Regnault's hygrometers, and to compare the results as found from the two hygrometers together.

To compare the readings of an aneroid barometer with those of a mercurial barometer up to 5 miles.

To determine the electrical state of the air.

To determine the oxygenic condition of the atmosphere by means of ozone papers.

To determine the time of vibration of a magnet on the earth, and at different distances from it.

To collect air at different elevations.

To note the height and kind of clouds, their density and thickness.

To determine the rate and direction of different currents in the atmosphere, if possible.

To make observations on sound.

To note atmospherical phenomena in general, and to make general observations.

*Instruments and Apparatus.*

The instruments used were mercurial and aneroid barometers; dry- and wet-bulb thermometers; Daniell's dew-point hygrometer; Regnault's condensing hygrometer; maximum and minimum thermometers; a magnet for horizontal vibration; hermetically sealed glass tubes from which air had been exhausted; ozone papers; and an electrometer lent by Prof. W. Thomson of Glasgow.

*Barometers.*—The mercurial barometer employed in all the ascents was a Gay-Lussac's siphon barometer by Mr. P. Aidie, and is one of those used by Mr. Welsh in the year 1852 in his experiments. The inner diameter of its tube is 0·25 inch. The graduations were made on a brass scale, from its middle point upwards and downwards; each division was about 0·05 inch in length, representing twice that value, so that an observation of either the lower or upper surface of the mercury would give the approximate length of the column of mercury.

The readings of the upper end were alone taken, and the corrections applicable to this end have been applied to all observations.

The barometer was furnished with its own thermometer, whose bulb was immersed in a tube of mercury of the same diameter as that of the barometer.

This instrument sometimes read more than 20° in excess of that of the sensitive air-thermometer.

The aneroid barometers were made by Messrs. Negretti and Zambra; one was graduated to 13 inches, and the other to 5 inches—the latter instrument having been used in the ascents on August 18 and September 5, and the former on July 17. In consequence of a difference of reading between the aneroid and mercurial barometers on

July 17 (and as both instruments were broken, it was impossible to say which was in error), and as the correctness of the siphon barometer at low readings is dependent upon the evenness of the tube, another barometer was used in addition on September 5, made by and at the suggestion of Messrs. Negretti and Zambra, as follows :—

A tube 6 feet in length was filled with mercury and boiled throughout its whole length; a glass cistern was blown on the bottom of the tube, and bent upwards in the form of a siphon; a stopcock was placed between the tube and cistern, and whilst the mercury filled the entire tube, a mark was made on the cistern, at the level of the mercury in it, for zero; the stopcock was then gradually opened, and the mercury allowed to descend one or more inches. The rise which consequently took place in the cistern was carefully marked on the same side as "0" (zero); the stopcock was again opened and the same operation was repeated until 30 inches of mercury had left the upper part of the tube, and the successive levels of the mercury in the cistern had been accurately marked.

In finally making the barometer, the upper portion only of the tube was used; the cistern which had been at the end of the lower portion was removed and joined on the upper; and in graduating the scale of the barometer, the rise which took place in the cistern at every inch was deducted, and the scale reduced in its entire length, by the exact amount of the rise of the mercury in the cistern. This instrument was therefore probably as accurate at low readings as at high.

*Dry- and Wet-Bulb Thermometers.*—Two pairs of dry- and wet-bulb thermometers were employed; one pair as ordinarily used, their bulbs being protected from the direct rays of the sun by a double highly-polished silver shade, in the form of a frustrum of a cone, open at top and bottom. A cistern was fixed near to them, from which water was conveyed to the wet-bulb thermometer.

The bulbs of the second pair of dry- and wet-bulb thermometers were enclosed in two silver tubes placed side by side, and connected together by a cross tube joining their upper ends, and over both were placed double shades as in the other pair of thermometers. In the left-hand tube was placed the dry-bulb, and in the right-hand tube the wet-bulb thermometer. Towards the lower end of the left-hand tube there was an opening; by means of the aspirator a current of air was drawn in at this aperture, then passed the dry-bulb in its upward passage into the small horizontal tube, and from thence into the right-hand tube, passing downwards over the wet-bulb, and away by a flexible tube into the aspirator. These instruments were made by Messrs. Negretti and Zambra.

*Regnault's Condensing Hygrometer.*—This instrument was made with two thermometers, as described by Regnault in the 'Annuaire Météorologique de la France' for 1849, page 221, excepting that it was furnished with silver-gilt cups. The scale was of ivory, and the two thermometers were fixed in their cups by means of cork, for ready packing up. The instrument was made by Messrs. Negretti and Zambra.

*Daniell's Hygrometer* was of the usual construction, by Messrs. Negretti and Zambra.

*Exhausted Tubes for collecting Air.*—These tubes were partly constructed by Messrs. Negretti and Zambra, and partly by Mr. Casella.

The thermometers employed in the observations were exceedingly sensitive; the bulbs were long and cylindrical, being about $\frac{3}{4}$ths of an inch in length, $\frac{1}{12}$th of an inch in diameter. The graduations, extended to minus 40°, were all on ivory scales. These thermometers, on being removed from a room heated 20° above that of an adjoining apartment, acquired the temperature within half a degree in about 10 or 12 seconds; but in passing from a heated apartment to one of a lower temperature, it took more than double the time to approximate to within half a degree of the latter. They were so sensitive that scarcely any correction is required to be applied to them on account of sluggishness; and this was found to be the case by the very near agreement in the temperatures at the same height in the ascending and descending curves, in those cases where there was reason to believe that there had been no change of temperature at the same height, within the interval between the two series of observations.

## § 2. Observing Arrangements.

One end of the car was occupied by Mr. Coxwell; near the other, in front of myself, was placed a board or table, the extremities of which rested on the sides of the car; upon this board were placed suitable framework to carry the several thermometers, hygrometers, magnet, aneroid barometer, &c.; a perforation through it admitted the lower branch of the mercurial barometer to descend below, leaving the upper branch at a convenient height for observing. A watch was set to Greenwich time, and placed directly opposite to myself. The central space of the table was occupied by my note-book. The aspirator was fixed underneath the centre of the board, so as to be conveniently workable by either my feet or hands. Holes were cut in the board to admit the passage of the flexible

tubes, one of which passed to Regnault's hygrometer, and the other to the place of the dry- and wet-bulb thermometers previously referred to, both the tubes being furnished with stopcocks.

*Circumstances of the Ascents, and General Observations.*

The ascents were all made by Mr. Coxwell's large balloon,—three from Wolverhampton, four from the Crystal Palace, Sydenham, and one from Mill Hill, near Hendon, where the balloon had fallen the evening previous, and had been anchored during the night.

*Ascent from Wolverhampton, July* 17.—The balloon was inflated at the Stafford Road Gasworks, Wolverhampton, with carburetted gas, most carefully prepared by the Engineer, Mr. Thomas Proud, and frequently kept a long time for our use, the Directors of the Gas Company having most liberally, to their great inconvenience, placed a gasometer at our disposal for as long a time as we needed it. To the Directors of the Company and to Mr. Proud our best thanks are due; for on all occasions they showed the utmost anxiety to contribute to the success of the experiments, in which Mr. Joseph Walker, Mr. Joseph Cooper, and Mr. Proud took great interest.

The weather previously had been bad for a long time, and the ascent had been delayed some days in consequence: the wind was still blowing strongly from the west; and considerable difficulty was experienced in the preliminary arrangements, and no instrument was placed in its position before starting. The ascent took place at 9 h. 43 m. A.M.; at once the balloon was quiescent. A height of 3800 feet was reached before an observation could be taken; at 4000 feet clouds were entered, which were left at 8000 feet. The temperature of the air fell to 33°, and a height exceeding 10,000 feet had been passed before all the instruments were in working order. The sky was then noticed to be of a deep-blue colour, without a cloud of any kind upon its surface.

At starting, the temperature of the air was 59°, and dew-point 55°; at 4000 feet it was 45°, dew-point 33°, and descended to 26° at 10,000 feet, dew-point 19°, and then there was no variation of temperature between this height and 13,000 feet. During the time of passing through this space, both Mr. Coxwell and myself put on additional clothing, feeling certain that we should experience a temperature below zero before we reached 5 miles high; but to my surprise, at the height of 15,500 feet, the temperature, as shown by all the sensitive instruments, was 31°, dew-point 25°; and at each successive reading, up to 19,500 feet, the temperature increased, and was here at 42°, dew-point 24°. We had both thrown off all extra clothing. Within two minutes after this time, when we had fallen somewhat, the temperature again began to decrease with extraordinary rapidity, and was 16° or 27° less than it was 26 minutes before: at this time a height of 5 miles had been reached at about 11 A.M.

When the balloon had attained a height of 4 miles I wished to descend for one or two miles, and then to reascend; but Mr. Coxwell, who had been watching its progress with reference to the clouds below, felt certain that we were too near the Wash; prudence, therefore, caused us to abandon the attempt.

Our descent began a little after 11 A.M., Mr. Coxwell experiencing considerable uneasiness at our too close vicinity to the Wash: we came down quickly, passing from a height of 16,300 feet to one of 12,400 feet between 11 h. 38 m. and 11 h. 39 m.: dipping into a dense cloud at this elevation, which proved to be no less than 8000 feet in thickness, and whilst passing through this the balloon was invisible from the car. Mr. Coxwell had reserved a large amount of ballast, which he discharged as quickly as possible to check the rapidity of the descent; but notwithstanding all his exertions, as we collected weight by the condensation of that immense amount of vapour through which we were passing, the descent was necessarily very rapid, and we came to the earth with a very considerable shock, which broke nearly all the instruments. All the sand was discharged when we were at a considerable elevation: the amount we had at our disposal at the height of 5 miles was fully 500 lbs.: this seemed to be more than ample, and, when compared with that retained by Gay-Lussac, viz. 33 lbs., and by Rush and Green, when the barometer reading was 11 inches, viz. 70 lbs., seemed indeed to be more than we could possibly need, yet it proved to be insufficient.

The descent took place at Langham, near Oakham in Rutlandshire, in a meadow near the residence of Mr. E. G. Baker, from whom we received the utmost attention.

*Ascent from the Crystal Palace, July* 30.—A table was fixed to the side of the car, partly within and partly without. The instruments were placed on a framework, fixed to the part of the table outside, so as to be beyond the influence of the occupants of the car: my note-book, watch, and aneroid barometer rested on the inner part of the table. The air was in gentle motion from the south-west, enabling the instruments to be made ready for observation before starting; and at 4 h. 40 m. P.M. the balloon left the earth.

The temperature declined instantly. Observations were taken every minute or half-minute from the time of ascent to as near as possible the time of descent.

The readings of one barometer were kindly made by Mr. W. F. Ingelow; and he also assisted me in observing the first appearance of dew on the hygrometer.

A height of 7000 feet was reached at about 6 o'clock; and the descent began about a quarter past 6: it was rather rapid, but quite under control, and we reached the earth at the village of Singlewell, near Gravesend, at 6 h. 30 m.

*Ascent from Wolverhampton, August* 18.—The weather on this day was favourable: there was but little wind, and that blowing from the N.E. By noon the balloon was nearly inflated; and as it merely swayed in a light wind, all the instruments were fixed before starting; and at 1 h. 2 m. 38 s. P.M. Mr. Coxwell pulled the spring-catch. For a moment the balloon remained motionless, and then rose steadily, almost perpendicularly: this ascent was all that could be desired. In about 10 minutes we passed through a fine cumulus cloud, and then emerged into a clear space with a beautiful blue sky dotted over with cirrus clouds above. When at the height of nearly 12,000 feet, with the temperature of 38°, or 30° less than on the ground, and dew-point 26°, Mr. Coxwell discharged gas, and we descended to a little above 3000 feet at 1 h. 48 m.; a very gradual descent then took place till 2 h. 30 m., when a height of about 24,000 feet was obtained; and here a consultation took place as to the prudence of discharging more ballast or retaining it, so as to ensure a safe descent: ultimately it was determined not to go higher, as some clouds, whose thickness we could not tell, had to be passed through. The descent began soon after, and we reached the earth a little after 3 o'clock at Solihull, about 7 miles from Birmingham.

*Ascent from the Crystal Palace, August* 20.—The air was almost calm, the instruments were all fixed before starting, and the balloon left the Crystal Palace at 6 h. 26 m. P.M., the temperature at the time being 66°, dew-point 54°. By 6 h. 35 m. we were half a mile high, the temperature being 56°. At 6 h. 37 m. the height of three-quarters of a mile was attained, and the air was so tranquil that we were still over the Palace. At 6 h. 43 m., when at the height of nearly a mile, a thick mist or thin cloud was entered, the earth being just visible. The temperature at this time was 40°, dew-point 46°: this elevation and temperature were maintained for about five minutes, and we then descended 200 or 300 feet. Kennington Oval was in sight. At 7 h. 9 m. St. Mark's Church, Kennington, was exactly underneath us. We were now about a mile in height, with a temperature of 48°, and dew-point 46°; the hum of London was heard, and there was scarcely a breath of air stirring.

A descent was gradually made to 1200 feet by 7 h. 20 m.; the lamps were being lighted over London, the hum of London greatly increasing in depth. At this time shouting was heard of people below who saw the balloon: a height of between 1500 and 2500 feet was maintained till 7 h. 40 m., the temperature varying from 57° to 54°, and dew-point about 47°. The river appeared dull, but the bridges that spanned it, as well as street after street as lighted up, and the miles of lights, sometimes in straight lines, sometimes winding like a serpent, or in some places forming a constellation at some place of amusement, constituted a truly remarkable scene, associated as this appearance was with the deep sound, or rather roar of the traffic of the metropolis.

For a considerable time Kennington Oval and Millbank Penitentiary were in sight, and it seemed as though we could not get away from them. At 7 h. 30 m. Mr. Coxwell determined to ascend above the clouds. We were then about 2500 feet high, and the temperature was 53°, dew-point 46°. At 7 h. 42 m. a height of 3500 feet was attained, the temperature being 51°. At 7 h. 47 m. a height of one mile had been reached, and the temperature was 45°, dew-point 42°. It was very dark below, but there was a clear sky above, and a beautiful gleam of light appeared. We still ascended till the clouds were below us, tinged and coloured with a rich red: the temperature had now fallen to 43°; we were soon enveloped in a fog again. At 7 h. 52 m. the striking of a clock and the tolling of a bell were heard. It was quite dark below; but the sun tinged the tops of the clouds. At 8 h. 5 m. we were quite above the clouds, and it became light again; the hum of London gradually died away. By this time the temperature had increased to 55°, the barometer reading 23 inches, corresponding to a height of 7400 feet. After this we descended, and it became too dark to read the instruments. London again was seen, very different, indeed, in its appearance from when we could pick out every square, street, bridge, &c. by its lights; now, as seen through the mist, it had the appearance of a large conflagration of enormous extent: and the sky was lit up for miles around. After a time the lowing of cattle was heard, and we seemed to have left London, so Mr. Coxwell determined to pass through the clouds and examine the country beneath. We passed from the comparative light above to the darkness beneath, rapidly becoming darker, and found ourselves some little distance from London,

and shortly afterwards touched the ground, so gently that we were scarcely aware of the contact, in the centre of a field at Mill Hill, about one mile and a half from Hendon, and it was resolved to anchor the balloon for the night, with the view of making an early morning ascent.

*Ascent from Mill Hill, near Hendon, August* 21.—By half-past 4 A.M. the instruments were replaced, and the earth was again left. It was a dull, warm, cloudy morning, still rather dusk, the sky overcast with cirrostratus cloud. The temperature was nearly as high as 61°, and dew-point 59°. There were in the car, besides Mr. Coxwell and myself, Captain Percival, of the Connaught Rangers, Mr. Ingelow, and my son.

We at first rose very slowly; at 4 h. 38 m. we were 1000 feet high, and the temperature was 58°, dew-point 56°. At 4 h. 41 m. there was a break in the clouds to the east, and a beautiful line of light with gold and silver tints. Here and there the morning mist was sweeping. At 4 h. 51 m. the temperature was 50°, and dew-point 42°; scud was below us, and the cloud of night was in a transition state into cumulus, or the cloud of day, at the same level as we were, viz. about 3500 feet: black clouds were above, and mist was creeping along the ground. At 4 h. 55 m. we were above a mile high; the temperature was 43°, dew-point 43°; we were just entering cloud. At 4 h. 57 m. we were in cloud, surrounded by white mist; the temperatures of the air and the dew-point were alike, viz. 39¾°. The light rapidly increased, and gradually we emerged from the dense cloud into a basin surrounded by immense black mountains of cloud rising far above us; shortly afterwards we were looking into deep ravines of grand proportion, bounded with beautiful curved lines. The sky immediately overhead was blue, dotted with cirrus clouds.

As we ascended, the tops of the mountain-like clouds became silvery and golden. At 5 h. 1 m. we were level with them, and the sun appeared, flooding with golden light all the space we could see for many degrees, both right and left, tinting with orange and silver all the remaining space around us. It was a glorious sight! At 5 h. 10 m. a height of 8000 feet had been attained, and the temperature had increased from 38½° in the cloud to 41°. We still ascended, rather more quickly, as the sun's rays fell upon the balloon, each instant opening to us ravines of wonderful extent, and presenting to our view a mighty sea of clouds. Here arose shining masses of cloud in mountain-chains, some rising perpendicularly from the plain, dark on one side, and silvery and bright on the other, with summits of dazzling whiteness; some were of a pyramidal form, and a large portion undulatory or wavy, in some places subsiding into hollows, and in one place having the appearance of a huge lake; on the extremity of the horizon snowy peaks bounded the view, resembling Alpine ranges. Nor was the scene wanting in light and shade: each large mass of cloud cast a shadow, and this circumstance, added to the very many tints, formed a beautiful scene. At 5 h. 16 m. we were nearly two miles high, the temperature was 32°, and dew-point 13°; the air was therefore dry. At 5 h. 18 m. we were above two miles in height; the temperature was 31°, and dew-point 10°. By 5 h. 31 m. we were something less than three miles high: the temperature was 23°, and dew-point −15°, and it decreased to −19° by 5 h. 34 m. This elevation was maintained for half an hour, during which time the temperature increased 5° or 6° as the sun's altitude increased. Shortly after 6 o'clock it was determined to descend; the temperature, which had been as high as 27° had fallen to 23°. At 6 h. 13 m., at the height of 2¼ miles, we heard a train. At 6 h. 20 m. we were two miles high, and the temperature had increased to 39°, and dew-point to 19°: at this time I noticed the loud ticking of a watch. Captain Percival said he could not hear it; he was seated and I was standing; and some experiments were made, when it was found that when the ear was at the same level as the watch no sound was heard, but it was remarkably distinct on the ear being situated above it.

At the height of two miles the barking of a dog was heard; the temperature at this time (6 h. 24 m.) was 43°, and dew-point 10° lower. The shadow of the balloon, with an encircling oval of prismatic colours, was here very remarkable; and it increased in dimensions and vividness of colour till we entered a cloud at 6 h. 29 m. The increase of temperature, which had been in progress during the descent, was immediately checked, and on emerging from the cloud at 6 h. 33 m. the temperature was 43°, dew-point 38°. The earth was now in sight, without a ray of sunlight falling upon it. The temperature gradually increased to 56°, and dew-point to 50° at 1000 feet in height, and 62° on reaching the ground, as gently as on the preceding evening. at Dunton Lodge, near Biggleswade, on the estate of Lord Brownlow, where we received every attention and assistance from his agent, Mr. Paulger.

*Ascent from the Crystal Palace, September* 1.—The wind on this day blew from the E.N.E., the sky was almost covered with cirrostratus cloud, but the horizon was moderately clear. The ascent took place at 4 h. 40 m. P.M.; the temperature was 64°; the balloon rose to the height of half a mile in 4 minutes, the temperature decreasing to 51°, and dew-point to 43°. At this time the whole of the river Thames, from its mouth to beyond Richmond, was

in sight. At 5 h. 31 m., when we were about 4000 feet high, clouds were observed forming and following the whole course of the Thames, from the Nore up to the higher parts, and extending but little beyond its sides: *the clouds were parallel to the river*, following all its windings, and bendings. The Astronomer Royal has often seen this phenomenon over the part of the river commanded by the Royal Observatory; but it was scarcely expected that clouds throughout its whole course would have formed so simultaneously and uniformly. On referring to the state of the tide, it was found to be just high-water at London Bridge about this time, connecting the formation with the warm water from the sea. After 5 h. 40 m. we were higher than all clouds near us, excepting the uniform stratus cloud above us, which we never approached; and it was noted that the upper surface of the lower clouds was bluish white, the middle portion the pure white of the cumulus, and the lowest a blackish white, and from which rain was falling, and, as we afterwards learned, had been falling all the afternoon. We descended to 1300 feet nearly, but were still above the clouds: we then rose to 3000 feet, and rain fell upon the balloon from *the* upper stratum of cloud, and no difference of temperature from 54° was observed in the stratum between 1300 feet and 3000 feet, although a short time before, in passing downwards through this distance, the temperature had increased from 48° to 54°. The falling rain equalised the temperature. The balloon began to descend after this, and fell at 6 h. 15 m., near Woking in Surrey. The evening looked so unpromising, and rain was still falling, that it was thought unadvisable to fasten the balloon for the night, and attempt a high morning ascent, as was contemplated. In this ascent the observations of the barometers and Daniell's hygrometer were made by Mr. J. MacDonald, Assistant Sectetary to the British Meteorological Society.

*Ascent from Wolverhampton, September* 5.—This ascent had been delayed, owing to the unfavourable state of the weather. It commenced at 1 h. 3 m. P.M.; the temperature of the air was 59°, and the dew-point 50°: at the height of one mile it was 41°, dew-point 38°; and shortly afterwards we entered a cloud of about 1100 feet in thickness, in which the temperature of the air fell to 36½°, the dew-point being the same; thus indicating that the air was here saturated with moisture, On emerging from the cloud at 1 h. 17 m. we came upon a flood of strong sunlight, with a beautiful blue sky, without a cloud above us, and a magnificent sea of cloud below, its surface being varied with endless hills, hillocks, mountain-chains, and many snow-white masses rising from it. I here tried to take a view with the camera, but we were rising with too great rapidity, and going round and round too quickly to enable me to do so; the flood of light, however, was so great that all I should have needed would have been a momentary exposure, as Dr. Hill Norris had kindly furnished me with extremely sensitive dry plates for the purpose. We reached two miles in height at 1 h. 21 m.; the temperature had fallen to the freezing-point, and the dew-point to 26°. We were three miles high at 1 h. 28 m., with a temperature of 18°, and dew-point 13°; at 1 h. 39 m. we had reached four miles, and the temperature was 8°, and dew-point −15°; in ten minutes more we had reached the fifth mile, and the temperature had passed below zero, and then read −2°, and at this point no dew was observed on Regnault's hygrometer when cooled down to −30°; but a dew-point obtained from the readings of dry and wet gave −36°.

Up to this time I had taken observations with comfort. I had experienced no difficulty in breathing, whilst Mr. Coxwell, in consequence of the necessary exertions he had to make, had breathed with difficulty for some time. At 1 h. 51 m. the barometer reading was 11·05 inches, but which requires a subtractive correction of 0·25 inch, as found by comparison with Lord Wrottesley's standard barometer just before starting. I afterwards read the dry thermometer as −5°: this must have been about 1 h. 52 m., or later. I could not see the column of mercury in the wet-bulb thermometer, nor afterwards the hands of the watch, nor the fine divisions on any instrument. I asked Mr. Coxwell to help me to read the instruments, as I experienced a difficulty in seeing. In consequence, however, of the rotatory motion of the balloon, which had continued without ceasing since the earth had been left, the valve-line had become twisted, and he had to leave the car and mount into the ring above to adjust it. At this time I looked at the barometer, and found it to be 10 inches, still decreasing fast; its true reading, therefore, was 9¾ inches, implying a height of 29,000 feet. Shortly afterwards I laid my arm upon the table, possessed of its full vigour, and on being desirous of using it, I found it powerless; it must have lost its power momentarily. I tried to move the other arm, and found it powerless also. I then tried to shake myself, and succeeded in shaking my body. I seemed to have no limbs. I then looked at the barometer; and whilst doing so my head fell on my left shoulder. I struggled and shook my body again, but could not move my arms. I got my head upright, but for an instant only, when it fell on my right shoulder, and then I fell backwards, my back resting against the side of the car, and my head on its edge; in this position my

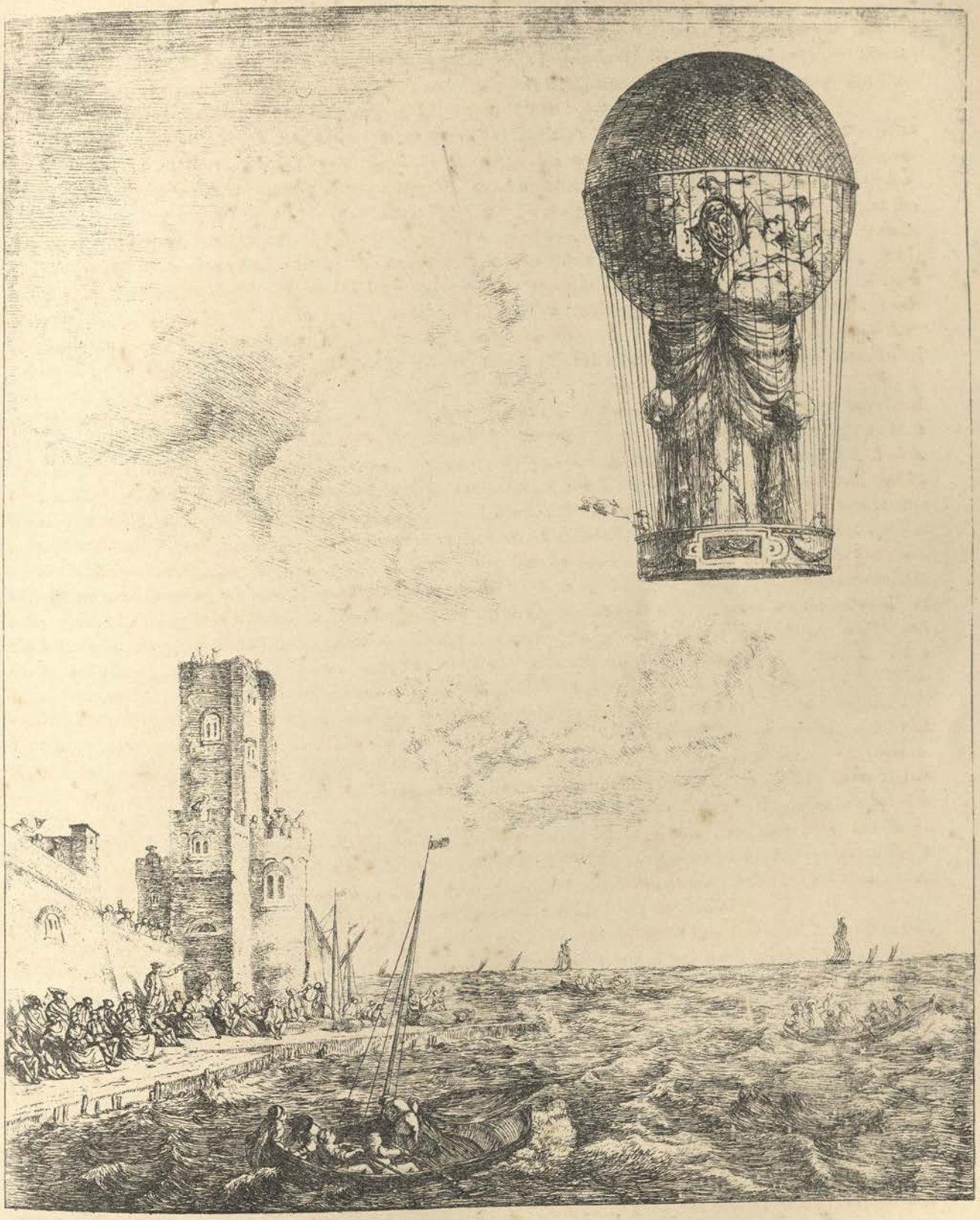

Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Hellsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director.

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eyes were directed towards Mr. Coxwell in the ring. When I shook my body I seemed to have full power over the muscles of the back, and considerable power over those of the neck, but none over either my arms or my legs; in fact I seemed to have none. As in the case of the arms, all muscular power was lost in an instant from my back and neck. I dimly saw Mr. Coxwell in the ring, and endeavoured to speak, but could not; when in an instant intense black darkness came, the optic nerve finally lost power suddenly. I was still conscious, with as active a brain as at the present moment whilst writing this. I thought I had been seized with asphyxia, and that I should experience no more, as death would come, unless we speedily descended: other thoughts were actively entering my mind, when I suddenly became unconscious as in going to sleep. I cannot tell anything of the sense of hearing; the perfect stillness and silence of the regions six miles from the earth (and at this time we were between six and seven miles high) is such that no sound reaches the ear.

My last observation was made at 1 h. 54 m. at 29,000 feet. I suppose two or three minutes fully were occupied between my eyes becoming insensible to seeing fine divisions and 1 h. 54 m., and then that two or three minutes more passed till I was insensible; therefore I think this took place at about 1 h. 56 m. or 1 h. 57 m. Whilst powerless I heard the words, "temperature" and "observation;" and I knew Mr. Coxwell was in the car speaking to me, and endeavouring to arouse me; therefore consciousness and hearing had returned. I then heard him speak more emphatically; but I could not see, speak, or move. I heard him again say, "Do TRY—NOW DO." Then I saw the instruments dimly, then Mr. Coxwell, and very shortly saw clearly. I rose in my seat and looked round, as though waking from sleep, though not refreshed by sleep, and said to Mr. Coxwell, "I have been insensible;" he said, "You have; and I, too, very nearly." I then drew up my legs, which had been extended before me, and took a pencil in my hand to begin observations. Mr. Coxwell told me that he had lost the use of his hands, which were black, and I poured brandy over them.

I resumed my observations at 2 h. 7 m., recording the barometer reading at 11·53 inches, and temperature − 2°. I suppose that three or four minutes were occupied from the time of my hearing the words "temperature" and "observation" till I began to observe; if so, then returning consciousness came at 2 h. 4 m., and this gives seven minutes for total insensibility. I found the water in the vessel supplying the wet-bulb thermometer, which I had by frequent disturbances kept from freezing, was one solid mass of ice; and it did not all melt until after we had been on the ground some time.

Mr. Coxwell told me that whilst in the ring he felt it piercingly cold; that hoar-frost was all round the neck of the balloon. On attempting to leave the ring he found his hands frozen, and he had to place his arms on the ring and drop down; that he thought for a moment I had laid back to rest myself; that he spoke to me without eliciting a reply; that he then noticed my legs projected and my arms hung down by my side; that my countenance was serene and placid, without the earnestness and anxiety he had noticed before going into the ring, and then it struck him I was insensible. He wished to approach me, but could not, and he felt insensibility coming over himself; that he became anxious to open the valve, but in consequence of having lost the use of his hands he could not, and ultimately did so *by seizing the cord with his teeth* and dipping his head two or three times until the balloon took a decided turn downwards. This act is quite characteristic of Mr. Coxwell. I have never yet seen him without a ready means of meeting every difficulty, as it has arisen, with a cool self-possession that has always left my mind perfectly easy, and given me every confidence in his judgment in the management of so large a balloon.

No inconvenience followed the insensibility; and when we dropped it was in a country where no conveyance of any kind could be obtained, so that I had to walk between seven and eight miles.

The descent was at first very rapid: we passed downwards three miles in nine minutes; the balloon's career was then checked, and we finally descended in the centre of a large grass-field belonging to Mr Kersall, at Cold Weston, seven-and-a-half miles from Ludlow.

I have already said that my last observation was made at a height of 29,000 feet; at this time (1 h. 54 m.) we were ascending at the rate of 1000 feet per minute; and when I resumed observations we were descending at the rate of 2000 feet per minute. These two positions must be connected, taking into account the interval of time between, viz. 13 minutes, and on those considerations the balloon must have attained the altitude of 36,000 or 37,000 feet. Again, a very delicate minimum thermometer read −12°, and this would give a height of 37,000 feet. Mr. Coxwell, on coming from the ring, noticed that the centre of the aneroid barometer, its blue hand, and a rope attached to the car, were all in the same straight line, and this gave a reading of 7 inches, and leads to the same result. Therefore these independent means all lead to about the same elevation, viz. fully *Seven Miles.*

In this ascent six pigeons were taken up. One was thrown out at the height of three miles, when it extended its wings and dropped as a piece of paper; a second, at four miles, flew vigorously round and round, apparently taking a dip each time; a third was thrown out between four and five miles, and it fell downwards as a stone. A fourth was thrown out at four miles on descending. It flew in a circle, and shortly alighted on the top of the balloon. The two remaining pigeons were brought down to the ground. One was found to be dead; and the other, a "carrier," was still living, but would not leave the hand when I attempted to throw it off, till after a quarter of an hour it began to peck a piece of ribbon which encircled its neck, and was then jerked off the finger, and flew with some vigour towards Wolverhampton. One of the pigeons returned to Wolverhampton on Sunday the 7th, and is the only one that has been heard of.

*Ascent from the Crystal Palace, September* 8.—The sky was for the most part obscured by clouds; the ascent took place at 4 h. 47 m. 28 s. P.M., the temperature on the ground being 67°; at 4 h. 52 m. we were half a mile high, with a temperature of 59°, and dew-point 54°; at 4 h. 55 m. we reached the clouds, with a temperature of 51½°, dew-point 49°, at the height of 4300 feet; we rose to 4800 feet, were still in the cloud, and then fell, passing out of the cloud downwards at 5 h. 1 m., with a temperature of 49°, and dew-point 46°; we descended to 3300 feet by 5 h. 7 m., where the temperature was 52°, dew-point 50°; we then ascended and again reached the cloud at a little over 4200 feet, and with the same temperature as before, viz. 51½°; we passed out of the cloud at a little over 4500 feet, into a basin, with blue sky above, and the sun shone beautifully; the balloon rose quickly, and the temperature increased from 51° on leaving the cloud to 57° at a mile in height, and to 59° and dew-point 40° at 5400 feet; we then descended, met with the cloud again at 5 h. 25 m., at the height of 5000 feet nearly, and experienced a temperature of 51°, dew-point 45°, whilst passing through it; we left the cloud at 4400 feet high, and the temperature rose from 51° to 61°, dew-point to 59°, at the height of 800 feet, and to 62° at the height of 700 feet, where we were at 5 h. 55 m.; at this time we were crossing the river Thames, near to Gravesend, and we passed from bank to bank in 121 seconds; we then rose to nearly half a mile, and passed Tilbury Fort at the distance of 2 miles; and with a telescope I examined the Fort, and could have drawn its plan and counted any guns within it. We fell at about 4 miles from the Fort at 6 h. 10 m. P.M.

In this ascent Mr. W. C. Nash, of the Magnetical and Meteorological Department of the Royal Observatory, Greenwich, took the observations of the barometer and Daniell's hygrometer.

TABLE I.—METEOROLOGICAL OBSERVATIONS MADE IN THE BALLOON ASCENT FROM WOLVERHAMPTON, SEPT. 5, 1862.

| References to Notes. | Time. | Siphon Barometer. | | Aneroid Barometer, No. 1. | Height above Sea-level. | Dry and Wet Thermometers (free). | | | | Negretti and Zambra's Gridiron Thermometer. | Dry and Wet Thermometers (aspirated). | | | | Hygrometers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reading corrected and reduced to 32° Fahr. | Att. Therm. | | | Dry. | Wet. | Diff. | Dew-point. | | Dry. | Wet. | Diff. | Dew-point. | Daniell's Dew-point. | Regnault's Dew-point. |
| | H. M. S. | inches. | ° | inches. | feet. | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| | 1 5 30 P.M. | 28·57 | 58·0 | 28·60 | 1,290 | | | | | | | | | | | |
| (1) | 1 5 50 ,, | .. | .. | .. | .. | 56·5 | 52·5 | 4·0 | 47·9 | | | | | | | |
| | 1 6 0 ,, | 28·38 | 57·0 | 28·35 | 1,480 | 55·5 | 51·1 | 4·4 | 46·9 | | | | | | | |
| | 1 10 0 ,, | 26·19 | 55·0 | 26·20 | 3,660 | 45·5 | 43·5 | 2·0 | 41·2 | .. | 46·0 | 43·8 | 2·2 | 41·3 | .. | 42·0 |
| | 1 11 0 ,, | .. | .. | 25·82 | 4,116 | 44·2 | 42·5 | 1·7 | 40·4 | 44·2 | | | | | | |
| | 1 11 30 ,, | 25·491 | 54·0 | 25·62 | 4,388 | .. | .. | .. | .. | .. | 43·3 | 41·5 | 1·8 | 39·3 | .. | 38·5 |
| | 1 12 0 ,, | 24·994 | 53·0 | .. | 4,920 | 42·0 | 40·5 | 1·5 | 38·7 | | | | | | | |
| | 1 12 30 ,, | 24·894 | .. | .. | 5,011 | 41·0 | 39·8 | 1·2 | 38·3 | 40·7 | | | | | | |
| | 1 13 0 ,, | 24·30 | .. | 24·45 | 5,675 | 39·5 | 38·2 | 1·3 | 36·5 | .. | .. | .. | .. | .. | 38·0 | |
| (2) | 1 13 30 ,, | 24·25 | 52·0 | .. | 5,722 | 38·0 | 37·2 | 0·8 | 36·1 | | | | | | | |
| (3) | 1 14 0 ,, | | | | | | | | | | | | | | | |
| (4) | 1 14 30 ,, | 23·70 | .. | 23·90 | 6,330 | 36·5 | 36·5 | 0·0 | 36·5 | 36·5 | | | | | | |
| (5) | 1 16 0 ,, | 23·35 | 50·0 | 23·40 | 6,729 | | | | | | | | | | | |
| (6) | 1 16 30 ,, | .. | .. | .. | .. | 36·3 | 36·3 | 0·0 | 36·3 | 36·0 | | | | | | |
| | 1 17 0 ,, | 23·20 | 50·0 | .. | 6,914 | .. | .. | .. | .. | .. | 36·0 | 36·0 | 0·0 | 36·0 | .. | 35·5 |
| (7) | 1 17 20 ,, | .. | .. | .. | .. | 38·2 | 36·1 | 2·1 | 33·3 | 39·5 | | | | | | |
| (8) | 1 17 40 ,, | 22·658 | 49·0 | 22·71 | 7,575 | 39·0 | 35·2 | 3·8 | 30·2 | 40·0 | | | | | | |
| (9) | 1 21 0 ,, | 20·717 | 46·0 | 20·60 | 9,926 | 33·5 | 31·1 | 2·4 | 26·6 | 32·1 | | | | | | |
| (10) | 1 22 0 ,, | 20·070 | 45·0 | 20·17 | 10,770 | 31·1 | 30·5 | 0·6 | 28·9 | 31·2 | .. | .. | .. | .. | .. | 25·0 |

(1) Misty. (2) In cloud, wholly obscured. (3) Lighter. (4) Much lighter, still in cloud.
(5) Gun heard. (6) Dense cloud. (7) Out of cloud.
(8) Tried Camera upon beautiful clouds—failed; the balloon was spirating and ascending too quickly. (9) Deep blue sky.
(10) The ice not properly formed on Wet-bulb thermometer.

TABLE I.—METEOROLOGICAL OBSERVATIONS MADE IN THE BALLOON ASCENT OF SEPT. 5TH.

| References to Notes. | Time. | Siphon Barometer. Reading corrected and reduced to 32° Fahr. | Siphon Barometer. Att. Therm. | Aneroid Barometer, No. 1. | Height above Sea-level. | Dry and Wet Thermometers (free). Dry. | Wet. | Diff. | Dew-point. | Negretti and Zambra's Gridiron Thermometer. | Dry and Wet Thermometers (aspirated). Dry. | Wet. | Diff. | Dew-point. | Hygrometers. Daniell's Dew-point. | Regnault's. Dew-point. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H. M. S. | inches. | ° | inches. | feet. | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| | 1 24 0 P.M. | 18·727 | 42·0 | .. | 12,568 | .. | .. | .. | .. | 26·5 | 24·5 | 23·0 | 1·5 | 14·5 | .. | 25·0 |
| | 1 25 30 ,, | 17·931 | .. | 18·10 | 13,715 | 25·5 | 25·0 | 0·5 | 22·3 | | | | | | | |
| | 1 26 0 ,, | .. | .. | .. | .. | 23·2 | 25·0 | | | | | | | | | |
| | 1 27 0 ,, | 16·936 | 38·0 | 16·90 | 15,184 | | | | | | | | | | | |
| | 1 27 30 ,, | .. | .. | .. | .. | 17·2 | 23·0 | | | | | | | | | |
| | 1 28 0 ,, | 16·686 | 36·0 | 16·65 | 15,510 | .. | .. | .. | .. | 18·0 | | | | | | |
| (1) | 1 28 30 ,, | .. | .. | .. | .. | 16·5 | 19·0 | .. | .. | 17·9 | 17·0 | 24·0 | | | | |
| | 1 29 0 ,, | 16·046 | 32·0 | .. | 16,520 | 16·5 | 17·0 | | | | | | | | | |
| | 1 29 20 ,, | .. | .. | 15·82 | .. | .. | .. | .. | .. | 17·8 | .. | .. | .. | .. | .. | 10·5 |
| | 1 30 0 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 16·2 | | | | | | |
| (2) | 1 30 15 ,, | .. | .. | .. | .. | 16·0 | 13·1 | 2·9 | − 9·2 | | | | | | | |
| | 1 30 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | 17·0 | 13·2 | 3·8 | −15·7 | | |
| (3) | 1 32 0 ,, | 15·38 | 30·0 | .. | 17,590 | 15·0 | 12·1 | 2·9 | −10·3 | 15·5 | | | | | | |
| (4) | 1 34 0 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | −5·5 |
| | 1 35 0 ,, | 14·651 | 28·0 | 14·90 | 18,890 | | | | | | | | | | | |
| | 1 36 0 ,, | 14·553 | .. | 14·80 | 19,068 | | | | | | | | | | | |
| | 1 37 0 ,, | 14·553 | 27·0 | .. | 19,068 | .. | .. | .. | .. | 15·6 | 15·5 | 11·3 | 4·2 | −21·1 | | |
| | 1 37 10 ,, | .. | .. | .. | .. | 15·0 | 11·1 | 3·9 | −18·1 | | | | | | | |
| | 1 37 20 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 15·8 | .. | .. | .. | .. | − 8·0 | |
| | 1 37 30 ,, | 14·469 | .. | 14·80 | 19,222 | | | | | | | | | | | |
| | 1 37 40 ,, | .. | .. | 14·40 | | | | | | | | | | | | |
| (5) | 1 37 50 ,, | .. | .. | .. | .. | 14·5 | 10·2 | 4·3 | −13·0 | .. | .. | .. | .. | .. | −10·0 | |
| | 1 38 0 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | 14·2 | 10·5 | 3·7 | −18·1 | | |
| | 1 38 10 ,, | .. | .. | .. | .. | 13·2 | 10·0 | 3·2 | −14·8 | 12·9 | | | | | | |
| | 1 38 20 ,, | 14·947 | 30·5 | .. | 19,960 | | | | | | | | | | | |
| | 1 38 25 ,, | .. | .. | 14·28 | 20,126 | | | | | | | | | | | |
| (6) | 1 38 30 ,, | 13·947 | | | | | | | | | | | | | | |
| | 1 38 35 ,, | | | | | | | | | | | | | | | |
| | 1 38 40 ,, | .. | .. | 14·00 | | | | | | | | | | | | |
| | 1 38 50 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 8·0 | | | | | | |
| (7) | 1 39 0 ,, | 13·76 | .. | .. | 20,393 | 8·0 | 4·5 | 3·5 | −22·7 | 8·5 | | | | | | |
| | 1 40 0 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 9·2 | .. | .. | .. | .. | − 9·0 | |
| | 1 40 15 ,, | .. | .. | .. | .. | 10·2 | 8·1 | 2·1 | − 8·2 | .. | .. | .. | .. | .. | .. | −15·0 |
| (8) | 1 40 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 11·0 | 9·5 | 7·8 | 1·7 | − 5·3 | | |
| | 1 41 20 ,, | 13·35 | 26·0 | .. | 21,182 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | −15·0 |
| | 1 41 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | −20·0 |
| (9) | 1 41 40 ,, | | | | | | | | | | | | | | | |
| (10) | 1 41 50 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 4·5 | | | | | | |
| (11) | 1 44 0 ,, | 12·754 | .. | .. | 22,380 | 8·1 | 4·2 | 3·9 | −26·0 | | | | | | | |
| (12) | 1 45 0 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7·3 | 4·5 | 2·8 | −17·3 | | |
| (13) | 1 48 0 ,, | 11·954 | 25·0 | .. | 23,976 | 0·0 | −4·0 | 4·0 | −35·2 | .. | .. | .. | .. | .. | .. | {no dew. −30·0 |
| | 1 50 0 ,, | 11·254 | .. | .. | 25,382 | .. | .. | .. | .. | − 2·0 | | | | | | |
| (14) | 1 51 0 ,, | 10·803 | .. | .. | 26,350 | −5·0 | .. | .. | .. | − 5·0 | | | | | | |
| | 1 53 ± ,, | 9·753 | .. | .. | 29,000 | | | | | | | | | | | |
| | 2 7 0 ,, | .. | .. | 11·53 | 25,318 | −2·0 | .. | .. | .. | − 2·0 | | | | | | |
| | 2 8 0 ,, | 12·354 | .. | .. | 23,021 | | | | | | | | | | | |
| | 2 8 30 ,, | 12·554 | .. | 12·80 | 22,654 | .. | .. | .. | .. | + 2·0 | | | | | | |
| | 2 8 45 ,, | 13·154 | 26·0 | .. | 21,650 | .. | .. | .. | .. | 11·0 | | | | | | |
| | 2 9 0 ,, | 14·054 | .. | .. | 20,018 | 17·0 | 11·0 | 6·0 | −34·7 | | | | | | | |
| | 2 9 30 ,, | 16·374 | .. | 16·45 | 16,015 | .. | .. | .. | .. | 18·0 | | | | | | |
| | 2 9 40 ,, | 17·074 | .. | .. | 14,938 | | | | | | | | | | | |
| | 2 10 0 ,, | .. | .. | .. | .. | 22·5 | 15·8 | 6·7 | −27·0 | | | | | | | |
| | 2 11 0 ,, | 17·71 | .. | .. | 14,012 | | | | | | | | | | | |
| | 2 12 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 23·2 | | | | | | |
| | 2 14 0 ,, | 18·05 | .. | .. | 13,520 | .. | .. | .. | .. | 24·5 | | | | | | |
| | 2 14 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | 24·8 | 18·0 | 6·8 | −19·6 | | |
| (15) | 2 15 0 ,, | 18·455 | .. | .. | 12,900 | | | | | | | | | | | |
| | 2 16 0 ,, | .. | .. | 19·10 | 12,250 | 26·5 | 18·2 | 8·3 | −22·4 | | | | | | | |
| (16) | 2 16 10 ,, | 10·753 | .. | 19·90 | 11,150 | | | | | | | | | | | |
| | 2 16 20 ,, | 20·053 | .. | 20·25 | 10,780 | | | | | | | | | | | |
| (17) | 2 16 50 ,, | 20·653 | 27·0 | 20·65 | 10,070 | 31·1 | 23·1 | 8·0 | + 2·5 | 31·1 | | | | | | |
| | 2 17 30 ,, | 21·151 | .. | 21·55 | 9,370 | | | | | | | | | | | |
| | 2 18 0 ,, | .. | .. | .. | .. | 33·0 | 25·0 | 8·0 | 9·3 | | | | | | | |

(1) Earth visible in patches. (2) The Wet-bulb reads correctly. (3) Ozone: Moffat 2; Moffat 2; Schönbein 0.
(4) Mr. Coxwell pants for breath. (5) Mercury of Daniell's hygrometer invisible.
(6) Ozone: Moffat 3; Moffat second paper 3; Schönbein 1. (7) Sand out. (8) Aspirator difficult to work.
(9) Ozone: Moffat 4. (10) See with difficulty. (11) Experienced a difficulty in reading the instruments.
(12) Aspirator troublesome. (13) Sand out. (14) Lost myself; could not see to read the instruments.
(15) Ozone: Moffat 5; Moffat second paper 5; Schönbein 2. (16) Wind east. (17) Gun heard.

TABLE I.—METEOROLOGICAL OBSERVATIONS MADE IN THE BALLOON ASCENT OF SEPT. 5TH.

| References to Notes. | Time. | Siphon Barometer. | | Aneroid Barometer, No. 1. | Height above Sea-level. | Dry and Wet Thermometers (free). | | | | Negretti and Zambra's Gridiron Thermometer. | Dry and Wet Thermometers (aspirated). | | | | Hygrometers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reading corrected and reduced to 32° Fahr. | Att. Therm. | | | Dry. | Wet. | Diff. | Dew-point. | | Dry. | Wet. | Diff. | Dew-point. | Daniell's Dew-point. | Regnault's, Dew point. |
| | H. M. S. | inches. | ° | inches. | feet. | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| | 2 19 0 P.M. | .. | .. | .. | .. | 34·2 | 25·9 | 8·3 | 11·3 | | | | | | | |
| | 2 19 30 ,, | 21·845 | 31·0 | 21·90 | 8,530 | | | | | | | | | | | |
| | 2 20 0 ,, | .. | .. | .. | .. | 35·2 | 27·0 | 8·2 | 13·9 | 35·2 | | | | | | |
| | 2 20 20 ,, | 22·041 | 33·0 | .. | 8,310 | | | | | | | | | | | |
| (1) | 2 20 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 14·0 | |
| (2) | 2 20 40 ,, | 22·241 | 33·0 | 22·20 | 8,090 | 40·1 | 29·2 | 11·9 | 15·2 | | | | | | | |
| | 2 21 30 ,, | | | | | | | | | | | | | | | |
| (3) | 2 22 0 ,, | .. | .. | .. | .. | 42·2 | 31·0 | 11·2 | 17·3 | | | | | | | |
| | 2 22 10 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 40·0 | | | | | | |
| (4) | 2 23 20 ,, | 22·637 | 35·0 | 22·76 | 7·625 | 42·0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 20·0 |
| | 2 23 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 40·0 | | | | | | |
| | 2 23 50 ,, | 22·932 | 37·0 | 23·20 | 7,260 | .. | .. | .. | .. | 40·0 | | | | | | |
| | 2 24 0 ,, | 23·028 | 39·0 | 23·00 | 7,150 | | | | | | | | | | | |
| | 2 25 0 ,, | 23·326 | 40·0 | .. | 6,810 | 42·0 | | | | | | | | | | |
| | 2 26 0 ,, | 23·473 | 41·5 | .. | 6,640 | | | | | | | | | | | |
| | 2 26 10 ,, | .. | .. | .. | .. | 42·0 | .. | .. | .. | 41·5 | | | | | | |
| (5) | 2 26 15 ,, | .. | .. | .. | .. | 45·2 | 34·2 | 11·3 | 21·5 | | | | | | | |
| | 2 27 0 ,, | | | | | | | | | | | | | | | |
| | 2 29 0 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 45·5 | .. | .. | .. | .. | .. | 27·0 |
| | 2 29 30 ,, | 24·512 | 46·0 | .. | 5,500 | 49·2 | 36·0 | 13·2 | 21·8 | | | | | | | |
| (6) | 2 30 30 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | 47·1 | 44·1 | 3·0 | 40·7 | 29·5 | |
| | 2 31 0 ,, | .. | .. | .. | .. | 49·0 | .. | .. | .. | 47·0 | | | | | | |
| | 2 31 30 ,, | .. | .. | .. | .. | 49·2 | 35·0 | 14·2 | 19·7 | | | | | | | |
| | 2 32 0 ,, | 25·401 | 50·0 | 25·55 | 4,521 | .. | .. | .. | .. | 48·0 | | | | | | |
| | 2 32 30 ,, | .. | .. | .. | .. | 50·5 | 36·0 | 14·5 | 20·8 | | | | | | | |
| | 2 33 0 ,, | 25·800 | 50·0 | .. | 4,110 | | | | | | | | | | | |
| | 2 33 30 ,, | .. | .. | .. | .. | 51·1 | 37·0 | 14·1 | 22·3 | | | | | | | |
| | 2 36 0 ,, | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 37·5 |
| | 2 38 0 ,, | 26·399 | 50·0 | 26·35 | 3,484 | 53·0 | 45·0 | 8·0 | 37·0 | 51·5 | | | | | | |
| | 2 38 10 ,, | .. | .. | .. | .. | .. | .. | .. | .. | 53·0 | 53·5 | | | | | |
| (7) | 2 38 20 ,, | | | | | | | | | | | | | | | |
| | 2 39 0 ,, | 27·598 | 50·0 | .. | 2,260 | | | | | | | | | | | |
| | 2 39 20 ,, | .. | .. | .. | .. | 54·0 | 48·0 | 6·0 | 42·1 | 54·0 | | | | | | |
| | 2 39 40 ,, | .. | .. | 28·10 | | | | | | | | | | | | |
| | 3 6 0 ,, | .. | .. | 29·02 | .. | 57·2 | 52·8 | 4·4 | 48·8 | 57·5 | | | | | | |

(1) Sand out. (2) Wet-bulb seems to be free from ice.

(3) After this observation I pressed the bulb of Wet thermometer between my thumb and finger, for the purpose of melting any ice remaining on it, or on the connecting-thread. (4) Ozone: Moffat's test 6.

(5) Wet-bulb seems to be correct; it has decreased from the reading I drove it to by the action of the heat of my thumb and finger.

(6) I do not think Aspirated Wet-bulb is correct. (7) Ozone: Moffat's paper 7.

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TABLE II.—SHOWING THE ADOPTED READING OF THE BAROMETER, CALCULATED HEIGHT ABOVE THE SEA, TEMPERATURE OF THE AIR, AND TEMPERATURE OF THE DEW-POINT IN THE SEVENTH BALLOON ASCENT FROM WOLVERHAMPTON. (See p. 234.)

*September* 5.

| Time of Observation. P.M. | Reading of the Barometer reduced to 32° F. | Height above the level of the Sea. | Temperature of the Air. | Temperature of the Dew-point. | Time of Observation. P.M. | Reading of the Barometer reduced to 32° F. | Height above the level of the Sea. | Temperature of the Air. | Temperature of the Dew-point. |
|---|---|---|---|---|---|---|---|---|---|
| H. M. S. | inches. | feet. | ° | ° | H. M. S. | inches. | feet. | ° | ° |
| 0 0 0 | .. | 490 | 59·5 | 48·4 | 14 30 | 23·70 | 6,330 | 36·5 | 36·5 |
| 1 5 0 | 29·17 | 720 | 59·0 | 50·5 | 16 0 | 23·36 | 6,729 | | |
| 5 20 | 28·97 | 909 | 57·2 | 50·1 | 16 30 | .. | (6,821) | 36·1 | 36·1 |
| 5 50 | .. | (1,340) | 56·5 | 47·9 | 17 0 | 23·21 | 6,914 | 36·0 | 35·7 |
| 6 0 | 28·38 | 1,480 | 55·5 | 46·9 | 17 20 | .. | (7,245) | .. | 33·3 |
| 10 0 | 26·19 | 3,660 | 45·5 | 41·5 | 17 40 | 22·66 | 7,575 | 39·5 | 30·2 |
| 11 0 | .. | 4,116 | 44·2 | 40·4 | 21 0 | 20·72 | 9,926 | 32·1 | 26·6 |
| 11 30 | 25·49 | 4,388 | 43·3 | 38·9 | 22 0 | 20·07 | 10,770 | 31·2 | 26·9 |
| 12 0 | 24·99 | 4,920 | 42·0 | 38·7 | 24 0 | 18·73 | 12,568 | 26·5 | 19·7 |
| 12 30 | 24·89 | 5,011 | 40·9 | 38·3 | 25 30 | 17·93 | (13,875) | 25·5 | 22·3 |
| 13 0 | 24·30 | 5,675 | 39·5 | 36·5 | 26 0 | .. | (14,312) | 23·2 | |
| 13 30 | 24·25 | 5,722 | 38·0 | 36·1 | 27 0 | 16·94 | 15,184 | | |

TABLE II.—SHOWING THE ADOPTED READING OF THE BAROMETER OF SEPT. 5TH.

| Time of Observation. P.M. | Reading of the Barometer reduced to 32° F. | Height above the level of the Sea. | Temperature of the Air. | Temperature of the Dew-point. | Time of Observation. P.M. | Reading of the Barometer reduced to 32° F. | Height above the level of the Sea. | Temperature of the Air. | Temperature of the Dew-point. |
|---|---|---|---|---|---|---|---|---|---|
| H. M. S. | inches. | feet. | ° | ° | H. M. S. | inches. | feet. | ° | ° |
| 1 27 30 | .. | (15,347) | 18·7 | | 10 0 | .. | (14,706) | 22·5 | |
| 28 0 | 16·69 | 15,510 | 18·0 | | 11 0 | 17·71 | 14,012 | | |
| 28 30 | .. | (16,015) | 17·9 | | 14 0 | 18·06 | 13,520 | 24·5 | |
| 29 0 | 16·05 | 16,520 | 17·9 | | 14 30 | .. | (13,210) | 24·8 | |
| 29 20 | .. | (16,640) | 17·8 | 10·5 | 15 0 | 18·46 | 12,900 | .. | 0·0 |
| 30 0 | .. | (16,875) | 16·2 | | 16 0 | .. | 12,250 | 26·5 | |
| 30 15 | .. | (16,965) | 16·0 | | 16 50 | 20·65 | 10,070 | 31·1 | |
| 30 30 | .. | (17,055) | 16·0 | | 19 0 | .. | (8,800) | 34·2 | |
| 32 0 | 15·40 | 17,590 | 15·5 | | 19 30 | 21·85 | 8,530 | | |
| 34 0 | .. | (18,180) | .. | − 5·5 | 20 0 | .. | (8,400) | 35·2 | |
| 37 0 | 14·55 | 19,068 | 15·6 | −21·1 | 20 20 | 22·04 | 8,310 | | |
| 37 20 | .. | (19,290) | 15·8 | − 8·0 | 20 40 | 22·24 | 8,090 | 40·1 | 15·2 |
| 38 0 | .. | (19,735) | 14·2 | | 22 0 | .. | (7,860) | 42·2 | 17·3 |
| 38 10 | .. | (19,847) | 12·9 | | 23 20 | 22·64 | 7,625 | 40·0 | 20·0 |
| 38 20 | 14·05 | 19,960 | | | 23 50 | 22·93 | 7,260 | 40·0 | |
| 38 25 | 13·95 | 20,126 | | | 24 0 | 23·03 | 7,150 | | |
| 38 50 | .. | (20,315) | 8·0 | − 5·0 | 25 0 | 23·35 | 6,810 | 42·0 | |
| 39 0 | 13·76 | 20,393 | 8·5 | | 26 0 | 23·47 | 6,640 | | |
| 40 0 | .. | (20,733) | 9·2 | − 9·0 | 26 10 | .. | (6,590) | | |
| 40 15 | .. | (20,818) | .. | −15·0 | 26 15 | .. | (6,560) | 45·2 | 21·5 |
| 40 30 | .. | (20,903) | 11·0 | | 29 0 | .. | (5,655) | 45·5 | 27·0 |
| 41 20 | 13·35 | 21,182 | .. | −15·0 | 29 30 | 24·51 | 5,500 | 47·0 | 21·8 |
| 41 50 | .. | (21,407) | 4·5 | | 30 30 | .. | (5,110) | 47·1 | 35·1 |
| 44 0 | 12·75 | 22,380 | | | 31 30 | .. | (4,720) | 49·2 | 19·7 |
| 48 0 | 11·95 | 23,976 | 0·0 | −30·0 | 32 0 | 25·40 | 4,521 | 48·0 | |
| 50 0 | 11·25 | 25,382 | − 2·0 | no dew | 32 30 | .. | (4,315) | 50·5 | 20·8 |
| 51 0 | 10·80 | 26,350 | | | 33 0 | 25·80 | 4,110 | | |
| 53 ± | 9·75 | 29,000 | − 5·0 | | 33 30 | .. | (4,050) | 51·1 | 22·3 |
| 2 7 0 | .. | 25,318 | − 2·0 | | 36 0 | .. | (3,735) | .. | 37·5 |
| 8 30 | 12·55 | 22,654 | + 2·0 | | 38 0 | 26·40 | 3,484 | 52·2 | 37·0 |
| 8 45 | 13·15 | 21,650 | 11·0 | | 39 0 | 27·60 | 2,260 | | |
| 9 0 | 14·05 | 20,018 | 17·0 | | 39 20 | .. | .. | 54·0 | 42·1 |
| 9 30 | 16·37 | 16,015 | 18·0 | | 3 6 0 | .. | on the ground | 57·2 | 48·8 |
| 9 40 | 17·07 | 14,938 | | | | | | | |

The reading of Regnault's hygrometer at 1h. 45m. was reduced to − 30°, without any deposition of moisture; the temperature of the dew-point was therefore at a lower degree. At 1h. 48m. the temperature of the dew-point, as determined by the Dry- and Wet-bulb thermometers, was − 35°, as shown below.

From the general agreement of the results as observed by Regnault's hygrometer and those of the dew-point as found by the Dry- and Wet-bulb thermometers, there can be no doubt that the temperature of the dew-point at heights exceeding 30,000 feet must have been as low as − 50°.

Mr. Glaisher's general remarks and conclusions, as derived from the eight balloon ascents here recorded by him in the Association Reports, are too important to be omitted :—

These eight ascents have led me to conclude, firstly, that it was necessary to employ a balloon containing nearly 90,000 cubic feet of gas; and that it was impossible to get so high as six miles, even with a balloon of this magnitude, unless carburetted hydrogen, varying in specific gravity from 370 to 330, had been supplied for the purpose.

It is true that these statements are rather conflicting when compared with the statements made by one or two early travellers, who professed to have reached some miles in height with small balloons. But if we recollect that at $3\frac{3}{4}$ miles high a volume of gas will double its bulk, we have at once a ready means of determining how high a balloon can go; and in order to reach an elevation of six or seven miles it is obvious that one-third of the capacity of the balloon should be able to support the entire weight of the balloon, inclusive of sufficient ballast for the descent.

The amount of ballast taken up affords another clue as to the power of reaching great heights. Gay-Lussac's ballast, as before mentioned, was reduced to 33 lbs. Rush and Green, when their barometers, as stated by them, stood at 11 inches, had only 70 lbs. left, and this was considered a sufficient playing-power. We found that it was desirable to reserve five or six hundred pounds; and although we could have gone higher by saving less, still on every occasion it was evident that a large amount of ballast was indispensable to regulate the descent and select a favourable spot for landing.

Secondly, it was manifest throughout our various journeys that excessive altitude and extended range as to distance are quite incompatible. The reading of the instruments establishes this; and it has been pointed out what a short time the balloon held its highest place, and how reluctantly it appeared to linger even at a somewhat less elevation. This was not owing to any leakage or imperfection in the balloon itself, for its efficiency has been well tested; and it remained intact a whole night without the least perceptible loss of gas.

It has been stated by an aeronaut of experience that strong opposing upper currents have been heard to produce an audible contention, and to sound like the "*roaring of a hurricane.*" Now, the only deviation we experienced from the most perfect stillness was a slight whirring noise in the netting, and this only when the balloon was rising with great rapidity, and a slight flapping on descending, when the balloon is in a collapsed state.

I may also state that the too readily accepted theory as to the prevalence of a settled west or north-west wind was not confirmed in our trips. Nor was the appearance of the upper surface of the clouds such as to establish the theory that the clouds assume a counterpart of the earth's surface below, and rise or fall like hills or dales.

Perhaps the most important conclusions which can be drawn from the experiments at present are:—

1. That the temperature of the air does not decrease uniformly with increase of elevation above the earth's surface, and consequently the theory of a decline of temperature of 1° in every 300 feet must be abandoned. In some cases, with a clear sky, the decline of 1° has taken place within 100 feet of the earth; and for a like decrease of temperature it is necessary to pass through more than 1000 feet at heights exceeding five miles.

   The determination of the decrease of temperature with elevation, and its law, is most important; and the balloon is the only means by which this element can be determined; but very many more experiments are, however, necessary.
2. That the humidity of the air decreases with height in a wonderfully decreasing ratio, till at heights exceeding five miles the amount of aqueous vapour in the atmosphere is very small indeed.
3. That an aneroid barometer read correctly to the first place, and probably to the second place of decimals, to a pressure as low as seven inches.
4. That dry- and wet-bulb thermometers can be used effectively up to any heights on the earth's surface where man can be located.
5. That the balloon affords a means of solving with advantage many delicate questions in physics; and,
6. That the observations can be made with tolerable safety to the observer; and therefore that the balloon may be used as a philosophical agent in many investigations.

The ascents which are most worthy to be compared to these in point of interest, are the ascents of MM. Biot and Gay-Lussac, made in 1804, for the purpose of scientific experiment, already given in this work. In reference to the eventful ascent of Mr. Glaisher and his companion, the following remarks are extracted from the 'Times':—

SCIENTIFIC BALLOON ASCENT.

(*Leading Article from the 'Times,' Sept.* 11, 1862.

Poetry has described some famous *descents*, and the *facilis descensus Averni* comes back with a familiar school twang to us. These dips into the subterranean world do not, indeed, belong to the region of historical truth, nor do they even profess to have been made for scientific purposes; yet, perhaps, they symbolise a certain spirit of discovery appropriate to those ages. The two chief adventurers into those parts, the two epic heroes, were great travellers,—the explorers of their day. Science has just now, however, surpassed all the fancy of poets. We have just had an *ascent* such as the world has never heard of or dreamed of. Two men have been nearer by some miles to the moon and stars than all the race of man before them. It is true they do not bring back a very glowing report of their approach to the region of the empyrean, yet their voyage upwards is not without poetical features. On reaching the clouds they find themselves among strange phenomena. They cut through a dense mass of moisture 2000 feet in thickness, after which the scene changes, they are received out of the thick fog into the clear blue vault of a liquid sky, and see the landscape of clouds beneath them. Mr. Glaisher attempts a photograph of the beautiful scene, but the rapidity of the flight defeats the process, and as the car mounts upwards the paper

refuses to receive the constantly vanishing impression from below. They now reach a fearful altitude, where pigeons—the unhappy victims of all experiments—cannot fly, and where, at last, the rarity of the air is too great for the physical structure of man, and one of the explorers faints and becomes unconscious. Yet such is the determination of men when they are in the act of experimentizing, and at the very climax of their feat, that they will not spoil it by a check so long as progress is possible; on they will go, and grudge forestalling their vertex by a foot, for every foot is so much gain and so much triumph. For ten whole minutes Mr. Coxwell ascended alone,—or rather worse than alone, with his companion insensible before his eyes, in a region six miles distant from the earth. That is a very extraordinary ten minutes if we think of it, that solitary command without a rival, of the boundless regions of space, when, for once, to be "alone in the world" was not a metaphor, and one head was working in the infinite void. It deserves to take its place among the unparalleled junctures and the critical and striking moments of war, politics, or discovery. But the feat was almost too audacious, and was carried on to the very verge of fate. Mr. Coxwell was only just in time to take the step which was necessary for a return to the lower world; another minute and he would have been stretched by the side of his companion, and a car, containing two human bodies, would have been mounting to worlds unknown, and encountering aerial storms and shipwrecks so removed from all our sublunary experience that we can hardly form the faintest image of the reality. We know enough of the geography of the heavens to know that it would not have been even dashed upon the bleak shore of a planet, or found a resting place upon some Ararat in the moon. But Mr. Coxwell's mouth performed the task which his paralysed hands were unequal to, and the release of the gas procured a descent, and gave a safe termination to the most audacious aerial feat ever performed.

The courage of men of science deserves to have a chapter of history devoted to it. It has been observed that courage is a very capricious and inconsistent virtue, and we all of us know the old anecdote of the gallant veteran of a hundred battles who durst not snuff out a candle with his fingers. Courage is a thing of habit, and sometimes it fails altogether immediately it is out of the field of its habit. Your bold rider is one who has begun young and becomes a sort of Centaur, only with the convenience of dropping off the animal part of his figure when he chooses; his whole body, with its muscles and sinews, has accommodated itself to the back of a horse, and acquired an intuitive and unconscious balance. But take him off his horse and, unless he has the *principle* of courage within him, he is an ordinary mortal, aad no more likes breaking his neck than a quiet humdrum citizen.

A soldier is accustomed to courage in company with gallant fellows around him; but that makes an immense difference. Company is both inspiring and relieving; it divests courage of its horrors and gloom. It is therefore much easier to be bold in company. But send your bristling warrior a nocturnal walk along a lane, and he sees ghosts peeping from behind haystacks, and hears supernatural voices in every gust of air. The feats of a man of science give you a better guarantee for real courage because they are solitary, deliberate, calm, and passive. It is true he has his enthusiasm which helps him, and he has his field of courage to which he has accustomed himself. But every new venture, every fresh essay upon this field is a solitary effort and impulse to him. He has to fight alone and by himself against the faintness of nature, without men shouting or flags flying, or trumpets clanging around him. He faces the invisible forces of nature, the gas that explodes or the poison that penetrates, with the countenance of a student and philosopher, and is at the disadvantage of having to be fully conscious and self-possessed, instead of having the aid of the swing and impetus of passion. The cool feats of our scientific men are known to us all—such as that of Sir Humphry Davy inhaling a particular gas, with an accurate report every minute or two of its successive effects upon his brain and senses. The aerial voyage just performed by Mr. Coxwell and Mr. Glaisher deserves to rank with the greatest feats of experimentalizers, discoverers, and travellers. It is true these gentlemen have not brought down a very comfortable or inspiring report of the upper world into which they have penetrated. Science and poetry are unhappily rather at variance upon the subject of the air and sky.

Poetry points upwards to the sky with glowing rapture as the scene of brightness and glory, and a residence there figures as the reward of heroism and greatness. Everything is happy and splendid that is connected with the sky. But science penetrates with its material eye into these vast upper spaces, and simply reports a great difficulty of breathing there, that the blood stagnates, the limbs become benumbed, the senses evaporate, and nature faints in unconsciousness. The very birds will not fly in that sky which is their poetical home. The distinction is that poetry looks up to the sky from below, and science examines and feels it on a level. The sky is the emblem of poetry—the fact of science. Both aspects of it are equally true, but the point of view from which they are taken is quite different. But, though our recent explorers of the sky do not add to its brilliancy as a picture, they have

furnished one more striking and impressive scene to the history of science. They have shown what enthusiasm science can inspire and what courage it can give. If the man, as the poet says, had need of "triple steel about his breast" who first launched a boat into the sea, certainly those had no less need of it who first floated in the air six miles above the surface of the earth.

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When science from creation's face
Enchantment's veil withdraws,
What lovely visions yield their place
To cold material laws.

CAMPBELL.

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On the 14th October, a pleasant party ascended from Winchester Barracks. To each of the members the idea that Schiller has so well expressed might be applied:—

Wie sprang, von kühnem Muth beflügelt,
Beglückt in seines Traumes Wahn,
Von keiner Sorge noch gezügelt,
Der Jüngling in des Lebens Bahn!
Bis an des Aethers bleichste Sterne
Erhob ihn der Entwürfe Flug;
Nichts war so hoch und nichts so ferne,
Wohin ihr Flügel ihn nicht trug.

DIE IDEALE.

Light, as by valour wing'd for air,
On life illumed by morning beams,
Sprang youth, as yet uncurb'd by care,
And blest in error's happy dreams (?):
Up to the ether's faintest star,
Did wild design adventurous soar—
Oh, nought too high, and nought too far
For those strong pinions to explore.

SIR BULWER LYTTON.

THE WINCHESTER ASCENT.

Two of the party wrote the following accounts:—

70 MILES IN 66 MINUTES.

*To the Editor of the 'Times.'*

A most successful aerial journey has this day been accomplished from Winchester to Harrow, travelling at the rate of a mile a minute.

Colonel M'Donald and six officers of the Rifle Depôt Battalion accompanied Mr. Coxwell in his mammoth balloon. Before this could be realised great anxiety had been felt by all concerned, the distance from the gasometer being half a mile and the last hundred yards of piping having to be laid above ground through the passages to the inner quadrangle. As the pipe was only four inches in diameter, the filling had to commence at nine o'clock on Monday morning. The weather was tempestuous, and strong equinoctial gales blowing from the south-west, bringing heavy clouds with rain almost precluded any hope of our aerial voyage being either pleasant

or safe. Owing to the zeal of Mr. Tinney, the gas manager, who spared no labour in providing the 90,000 cubic feet of gas—no ordinary task—and also to Mr. Coxwell's knowledge of the changeableness of the weather, the enterprise was not abandoned. All the arrangements made with calculation and forethought by Colonel M'Donald were successfully completed; every preparation for the convenience of spectators had been made; and the ancient Palace of Charles II. assumed the appearance of a Roman amphitheatre. It was hoped that a large sum of money would have been thus collected for the Lancashire Distress Fund, but on this point we were somewhat disappointed, as some thousands preferred to keep their shillings in their pockets and enjoy a surreptitious view from a distance.

Still, owing to frequent squalls, it was undecided at three o'clock whether the ascent should be made this day or postponed. A large crowd was, as usual, clamorous, and foolishly careless of any risk, but it would have had no effect in inducing Mr. Coxwell to "proceed" had not the sun come out and the heavy clouds dispersed. Then he decided, and the soldiers, obeying his signals with military exactness, drew the balloon to the windward side of the square; and at five minutes past four let go the rope, when we instantly rose in a majestic manner—clearing the corner we had so much feared by 150 feet—to a height of two miles. By passing over the Grange (Lord Ashburton's) eight minutes later we perceived that we were going at the rate of a mile a minute. The white and broken clouds were on this occasion between three and four miles from the earth. Our direction was E.N.E. We left Aldershot Camp two miles to the S.E., Virginia Water a mile to the N.W., and with great pleasure recognised the friendly shelter of Harrow-hill for a quiet descent. This, however, we passed by a mile, and landed in a grass-field belonging to Mr. Henry Hill. Here, in the gentlest manner possible, the grappling iron anchored us in the centre of the field, and, thanks to Mr. Coxwell's judgment, without the slightest concussion. With the hearty goodwill of the villagers, and the obliging assistance of Mr. Hill, we packed up and carried our balloon to the railway station. It was 5.15 o'clock when we descended, and the distance we had travelled in one hour and ten minutes exceeded seventy miles. As we reached the ground Mr. Coxwell was kind enough to show us the manner in which he performed the almost incredible feat of opening the valve with his teeth when *seven* miles above the earth (see p. 234.) *

C. F. T.

*London, Oct.* 14.

Mr. Coxwell having stated to me that our flight in his balloon from Winchester to Harrow, on Tuesday last, was one of the most successful and interesting which have been made, I am disposed to offer a few additional observations to those of your previous correspondent.

He made a slight mistake as regards the time in which the journey was performed, the distance being got over in one hour and six minutes—four minutes less than he computed.

It being necessary to move upwards with great velocity, an additional interest attached to the ascent. The moment the rope was loosed by our guide, we felt first a gentle movement, then a bound into space, almost a realisation of the "translation" of good men of old. It is hardly possible to describe how this movement outstripped thought. A fleeting vision passed the mind, of friends near becoming instantly distant, amid the waving of handkerchiefs, the strains of music, and the cheers of the crowd; we were high in air, however, before we could return these salutations.

At this period our velocity could not have been less than at the rate of three miles a minute, our course describing a parabolic curve, the balloon being moved by two forces—upwards by the dense masses of the lower air, and northwards by the wind. This pace gradually lessened till we reached our extreme altitude, upwards of two miles, when we took the more moderate rate of about seventy miles an hour, and travelled at the same elevation until almost over Chertsey, when we descended, in a parabola of less inflection, upon Staines. This descent was of great velocity, although the only effect felt by the aeronauts was the rotation of the balloon slowly. This was rapidly checked by the delivery of a sandbag, when for some time we preserved an altitude of about 900 feet; subsequently it became necessary to ascend to 1000 feet to clear Harrow-hill with the grapnel, which hung 100 feet below us, and was a scale by which we could estimate height; and our altitude was now gradually lessened until the descent was accomplished.

It was interesting to note the difference of the aerial currents. Until we passed over Staines, rippled waters were observable, and we anticipated a rough descent; near there, however, some smoke was seen to blow towards

* The party consisted of Colonel McDonald, Major Newdigate, C. Ramsbottom, W. M. Burrell, C. Fairfield, H. Turnor of the Prince Consort's Own Rifle Brigade, and J. S. Algar of the 60th Rifles.

the west, although our direction was northerly, indicating a lower and different current of wind. After our descent upon Staines we noticed our pace was diminished, and that we were probably moving at the rate of about thirty-five miles an hour, which pace appeared uniform until half a minute before touching ground, under the shelter of Harrow-hill.

London was to be seen, a great bank of fog, with buildings in its outskirts, which we left on our right.

I ought not to forget to mention a very brilliant effect produced by the sun striking on a cloud over the Isle of Wight. The cloud shone with an intensity equal to electric light. Nor should I forget our passage over the familiar scene of much military pomp in which we had figured—the great dust plain and hideous huts of Aldershot. There a solitary bugle call was detected by the sharp ears of our helmsman, who pointed out the value of balloons in military reconnaissance. Although at the height of two miles, any manœuvres upon the dust plain could have been easily seen. Even troops secreted behind the Reservoir, or in the hollows of Cæsar's Camp, would have been unable to hide from the searching eye of the aerostatic observer.

A. M.

A Winchester poet takes advantage of the occasion to refresh the mind by apt comparisons:—

ON THE ASCENT OF A BALLOON.

'Tis well for man that his aspiring mind
Should limits to his boundless wishes find;
The loftiest angels fell for lack of this,
And changed for endless woe their seats of bliss.
With genius all expansive, and a skill,
Prompt to perform whate'er may be his will;
And more than all, a heart to do, and dare
His duty, or his pleasure, careless where,
What would his restless, tow'ring spirit stay,
Uncheck'd by laws 'twere death to disobey?
He threads the bottom of the briny deep,
He climbs up snow-clad summits drear and steep
And midst the icebergs of the Esquimaux
Steers with a fearless helm his fragile prow;
Nor yet to roam on earth and sea content,
Up to the clouds he ventures an ascent;
And thus determined, lo! the means at hand
For this new voyage, which his bold thought has plann'd.

Behold yon silken web so finely spun,
Tho' worms prepar'd the skeins that thro' it run;
With wondrous life inspir'd, aloft it rears
Its form, as buoyant as the starry spheres,
And like a courser fretting at the rein
That serves awhile its spirit to restrain,
See how above those weights, that bid it stay,
It heaves, and rolls, and strives to soar away.
At length the word is giv'n, and with a bound
It surges up, and graceful leaves the ground.
Then upward, upward, with majestic flight
It soon ascends beyond the reach of sight,
View'd and admir'd by twice ten thousand eyes
That eager watch'd its blending with the skies.

But in that soaring globe the muse would see
An emblem of a glorious immortality;
Tho' now careering on, ere launching forth,
It seem'd a cumbrous mass upon the earth.
Lifeless it lay, as tho' unfit to rise,
And sail in triumph thro' the lofty skies.
Thus fallen man is seen laid dead, and down,
Beneath a load of trespass all his own.
But when the Spirit of the living God
Breathes in, and fills with life that mortal clod—
No longer dead, it moves, and straight begins
To rise above the burden of its sins.
It sees the blood from Jesu's side that flow'd,
And reads all cancell'd there the debt it ow'd.

And as those weights that hung upon the net
Did still forbid its upward soaring yet,
Until the signal, full of deep suspense,
Was given to bid the voyagers mount from hence;
Thus humbled still with many a weight within
Th' imprison'd soul laments its state of sin,
Yet by the power of prayer and faith made strong
It learns to bear and lift itself along;—
Lab'ring with constant struggles to be clear
From all those trammels that detain it here;
Till the last hour of life—and then are seen
Those deep librations, faith and sight between,
When fully conscious of its near release—
With trembling hope and joy, and deep-felt peace,
Freed from each earthly tie, each sin forgiv'n,
It soars sublimely to its blood-bought Heav'n—
Whilst weeping friends look on, and praise the Lord
For His abounding grace and faithful word.—J. C. P.

1863.—Mr. Glaisher continues to make many interesting and useful scientific experiments with regard to the atmosphere, by the assistance of Mr. Coxwell. In one of these pleasant excursions, on the 11th July, the author accompanied them, and the following is the account:—

COASTING IN A BALLOON.

*To the Editor of the 'Times.'*

Chichester, July 12, 1863.

On a former occasion you did me the honour to insert an account of a balloon trip till then the most rapid on record; and I now hope that you may again find room in the valuable space of your journal for an account of a

trip made yesterday by Mr. Glaisher and Mr. Coxwell, in which, by their kind permission, another gentleman and myself were allowed to join.

Having previously obtained the knowledge, from observation of the clouds and a paper-pilot, that the lower current was flowing almost due west, while the upper was from north to south, we rose quietly from the Crystal Palace at 4.46 P.M.

Mr. Glaisher, with a variety of instruments surrounding him, commenced at once his observations, which I hope may be published. The lower current carried us towards London, and we almost hoped to back Eton with our cheers, but unfortunately we reached the upper current, and were carried slowly past Croydon, where we observed tents, and a large concourse. We passed immediately over a beautiful park near Epsom, which Mr. Glaisher photographed. We crossed the South-Eastern Railway, between Buckland and Reigate Town. Here the rail, following the curves of the chalk-hills and Bletchworth, drew attention. Between this and Horsham we attained our greatest elevation, not much over a mile, as we wished to go distance, not height, hoping to cross the Channel; but the sluggishness of the atmosphere disappointed us. After once enjoying the pleasure of seeing the fields contracting, we allowed them to expand, and remained at a lower altitude. Passing immediately over Horsham, Mr. Glaisher took another photograph. We saw the sea, and from the inlet perceived that we were going straight for New Shoreham.

"The sea looks tempting," we all exclaimed; but, alas! it is seven o'clock, and our pace not rapid, so this must be postponed.

Mr. Coxwell drops us into the lower current, and we coast about five miles from the shore, at not more than 1500 feet, and sometimes only 600 feet from the ground. Nothing could be more enjoyable. Villagers shouting to us to come down, and occasionally answering our questions; the cheery cries of children; sheep flocking on the Downs, not knowing which way to go; geese cackling and scuttling off to the farms, other birds remaining in trees; while a pack of hounds was in the wildest excitement within their kennels, trying to get out. We passed immediately over the parks of Arundel and Dale, hearing the pheasants crowing as they went to roost.

Mr. Coxwell thought at this time of crossing the Solent, and landing in the Isle of Wight; but the wind getting a little more southerly, and knowing the inconvenience of the country near Portsmouth for landing when dark, we took advantage of an open piece of grass near the house at Goodwood, and descended soon after 8 P.M.

Mr. Coxwell, after throwing a rope to a cricketer, landed us so gently that we could not have crushed a daisy. We were afterwards drawn by a rope to the front of the house, for the benefit of a few gazers. I had hoped that Mr. Coxwell would here tether his balloon and continue our journey next day; but it was Sunday, and so he resolved to pack it up; otherwise, the upper current being again north, our wishes might this day have been happily accomplished.

Our thanks are due to Captain Valentine, and other good people there assembled, for the assistance they gave us in packing up.

C. H. T.

MR. GLAISHER'S TWELFTH BALLOON ASCENT.

*To the Editor of the 'Times.'*

Blackheath, July 14, 1863.

This ascent was intended to have combined both extreme height and distance, and almost until the time of leaving the earth there seemed to be a promise that both purposes in these respects could be realised. As the direction of the wind was almost due east, the paths of the pilot-balloons were such as to indicate that our course would have been towards Devonshire.

The sky was nearly covered with cirrus and cirro-stratus clouds, and the air was in very gentle motion. The earth was left at 4 h. 55 m., the balloon moving towards the west till 4 h. 59½ m., when, in a moment, we came under the influence of a north wind, and moved almost due south. At this time the balloon was 2400 ft. high. At 5 h. 19 m. we were nearly over Caterham, where a large number of persons was collected celebrating some festival. At 5 h. 36 m. we were near Epsom Downs; at 5 h. 49 m. near Reigate; at 6 h. 39 m. over Horsham; at 7 h. 14 m. within five or six miles of Brighton. Up to this time we had frequently consulted together, with the view of ascending higher, but it did not seem prudent to attempt extreme elevations, as we were moving so directly towards the sea, and therefore we kept low, with the prospect of crossing the Channel to France, and then ascending to four or five miles; but on approaching the Channel the circumstances did not promise success; we

therefore abandoned the attempt. On descending when at the height of about 2400 ft. we again fell in with an east wind, being exactly at the same elevation as we lost it at five o'clock. After this time we were compelled to keep at a low elevation, and moved very nearly parallel to the coast, at the rate of about fifteen miles per hour, at elevations varying from 1000 ft. to 2000 ft., till at 8 h. 35 m. we were over Goodwood Park, the seat of the Duke of Richmond, where Mr. Coxwell determined to descend, and managed the balloon so that finally it had to be pulled down, and we were not aware when the car touched the earth.

The temperature at the time of leaving at the Royal Observatory, Greenwich, was 75½ deg.; at the Crystal Palace it was 74 deg.; in the balloon it declined to 59 deg. by 5 h. 4 m. at the height of 3600 ft. We then entered a warm current, the temperature increasing to 61·5 deg., then decreased to 60 deg. at the height of 4300 ft. We determined to descend to repeat these observations, and found all temperatures down to 3000 ft. nearly 5 deg. higher than at the same heights on ascending. We then turned to ascend at 5 h. 35 m., and the temperature decreased gradually, agreeing with those at the same elevations as last taken, and continued to a height of 6200 ft. at 6 h. 28 m., where the temperature was 52½ deg.; we continued at this elevation with very slight variations for half an hour, during which time the temperature fell from 1 deg. to 2 deg.

At 7 h. we were nearing the coast, and we descended to 900 ft. by 7 h. 20 m., the temperature gradually and constantly increasing to 65½ deg. From this time we were moving westward, almost parallel to the coast, and were compelled to keep below 2000 ft. to avoid approaching the sea; and the temperature at these elevations varied from 63 deg. to 65 deg., and was 68½ deg. at Goodwood at 8 h. 50 m., about ten minutes after we had touched the ground. At this time, at Greenwich, the temperature was 64 deg.; at Brighton, as communicated to me by Mr. I. O. N. Rutter, it was 68 deg.

On comparing the successive temperatures at the same elevations, taken after 5 h. 8 m. with those at Greenwich a corresponding decrease was shown, but somewhat less in amount.

At 5 h. 27 m., when at the height of about 3000 ft., the 'Times' newspaper, folded four times, fell over the car. Its descent was watched. After a time it looked like a gull. It reached the ground at 5 h. 35 m., passing over seven or eight fields in its descent.

While passing from Brighton to Chichester, without any sense of motion ourselves, at an elevation of less than 2000 ft., over so beautiful a county, in all respects like Devonshire, with its fine parks of forest-trees, noblemen's mansions, and all the features of rural landscape,—a moving panorama, in fact, of great extent, appearing in quick succession, like a fairy scene,—the prospect was most enjoyable; and I must confess it was with some regret that we were compelled to conclude this aerial voyage.

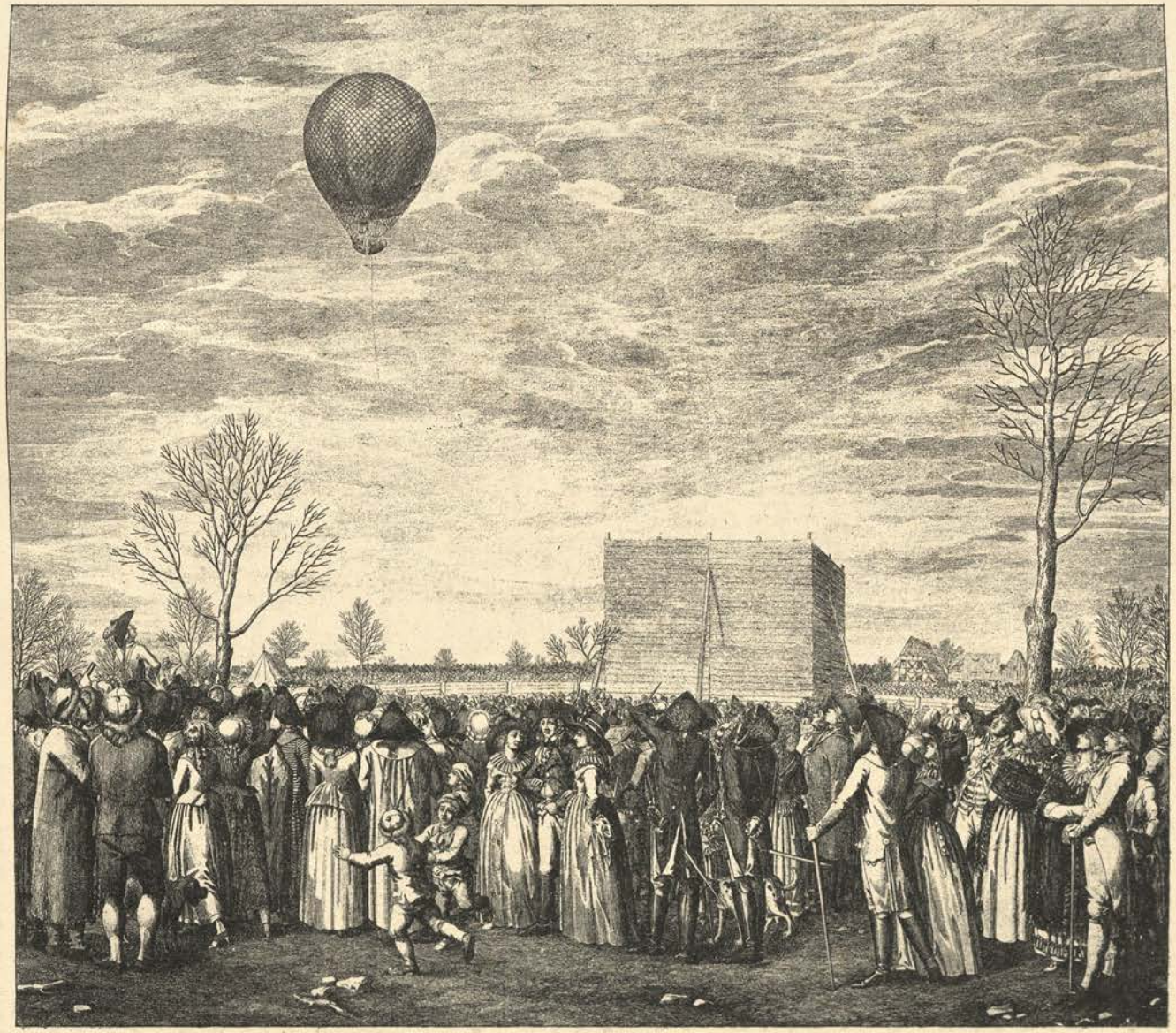
The currents of air on this occasion were remarkable: there was no transition state from one to the other; the stratum of air moving from the north must have been in contact with that from the east. After nearing Horsham the north wind must have been compounded with some west; that is, at heights exceeding 5000 ft., which was lost on falling below this height, for then for a time we were moving towards Worthing. When near the south coast the smoke was frequently moving in a different direction to that of the balloon: at Arundel it was moving in the opposite direction. It was this uncertain state of things which prevented us from passing to the Isle of Wight, as I very much wished to have some observations over the sea.

At the Royal Observatory, Greenwich, the horizontal movement of the air between the hours of five and nine was at a rate less than two miles an hour; while during three hours and three-quarters the balloon had passed between 60 and 70 miles.

It is very evident that our instruments on the earth do not give any indication of the real velocity of the air. A similar result was shown last year in Mr. Coxwell's rapid journey from Winchester, of 70 miles in 65 minutes, while the anemometer at Greenwich registered 14 miles only; and every occasion on which the actual motion of the air has been measured by the balloon it has been a *multiple* of that determined by instruments. The difference between the two is so large that it seems scarcely to be accounted for by the undulatory nature of the surface of land, and implies *that our hitherto estimated velocities of the air are erroneous.*

Shortly after we left, the sky was overcast, mostly with cirro-stratus clouds of such density that at times there were faint gleams of light from the sun; but for the most part the sun's place was only just discernible, and for some time before sunset there was no trace whatever of the sun.

These clouds, when viewed from a height exceeding 6000 ft., seemed then to be as far above as they did when viewed from the earth: they must have been four miles high at least. The atmosphere was thick and misty, very



Blanchards 28te Farth zu Nürnberg. den 12ten November Ao 1787.

Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H. Belsham James R.E. Col. Sir H. James R.E. F.R.S. &c. Director.

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distant objects were invisible; and the earth, not being lighted up by the sun at all, was dull, the fact of clouds reaching to four miles high, where the temperature of the dew-point must be some degrees below zero, as in the preceding ascent, implying the presence of very little water; yet there was enough in both cases not only to be visible, but to exclude everything beyond them. This fact is important, and indicates *that our theory of vapour must be reconsidered.*

We were favoured on this occasion with the company of Mr. Frederick Norris, of the Conservative Club, and Lieutenant H. Turnor, of the Rifle Brigade.

The place of descent was Goodwood Park, the seat of the Duke of Richmond; and our best thanks are due to Captain Valentine for the assistance he kindly gave us in everything—not only in having my instruments properly taken care of, packing up the balloon, &c., but also for his kind hospitality.

JAMES GLAISHER.

An ascent in Mr. Coxwell's Mammoth Balloon was made on August 31, from the Cricket Ground at Newcastle, during the Meeting of the British Association. The account is extracted from the 'Newcastle Daily Chronicle':—

This ascent took place yesterday, and the popular interest evinced was decidedly greater than that excited by any other event connected with the Association. Everybody could share the pleasure and excitement produced by a balloon ascent; and the great mass of our townsfolk did share in it. The Mayor, on the requisition of a number of our leading firms, had wisely appointed that the afternoon should be holden as a general holiday. The consequence was that all the positions surrounding the Cricket Ground, from which a view of the balloon could be obtained, were occupied early in the afternoon. In the enclosure itself, some hundreds of the members of the British Association were assembled. The inflation of the balloon began about half-past one in the afternoon, and was not completed till nearly six in the evening. The balloon employed on this occasion, we believe, was constructed by Mr. Coxwell specially for scientific ascents. It is of immense size and beautiful form, and requires 95,000 feet of gas to inflate it. Messrs. Coxwell and Glaisher usually perform their journeys alone; but on this occasion they were accompanied by Master G. W. Lee Glaisher, a son of Mr. Glaisher, about sixteen years of age, Captain Bond, Mr. Smith, and Mr. J. Pullan, one of our reporters. When Mr. Glaisher had arranged his delicate instruments, and Mr. Coxwell had adjusted his still more important machinery, the aerial monster, amidst the plaudits of the spectators, swiftly and steadily left the earth. The clouds were low at the time, so that the balloon was speedily hidden by them. As it rose higher, however, it was seen and lost again repeatedly as a diminishing object in the heavens. Glistening in the sunlight, it was not entirely lost to view for half an hour after it left the earth. The ascent was made so near to the coast that the direction of the wind was a matter of some moment, and several "pilots" were despatched to ascertain it. As the great balloon itself ascended, it took a southerly direction, but diverged slightly to east as it got into higher currents of air. The proceedings were enlivened by the performances of the bands of the 1st Newcastle and the Northumberland Artillery Volunteers, permitted to be present by the kindness of the commanding officers. The balloon was the "Mammoth" with which Mr. Glaisher and Mr. Coxwell have made all their scientific ascents.

Having described the balloon as seen from the earth, we will now describe the earth as seen from the balloon.

THE VOYAGE.

The following is the account of our own reporter, who was favoured with a place in the balloon:—

At twelve minutes past six o'clock, and cheered by the hurrahs of the assembled people, we rose smoothly from the earth. The sight of a thousand up-turned faces, all evincing astonishment and delight, was a fair parting scene, and omened well for our evening voyage. The first glance around showed that not only was the Cricket Ground thronged with spectators, but in the adjacent streets people appeared to be closely packed. The town lay below us, the streets, squares, towers, spires, and monuments spread out as we see them in those old engravings grey with the age of centuries. The novelty of the situation, however, prevented me from comprehending at one glance the whole extent of Newcastle and the surrounding district. There was so much more to see from this uninterrupted point of view, that the eye acquainted with even the widest ranges obtained from mountain-tops could not at once grasp the clearly-defined landscape that lay beneath. There was much to admire, but still more

to confuse the mind, and before my thoughts were sufficiently collected to allow me to take a systematic survey, we were into a cloud. The idea of being so soon amongst the clouds did not at the moment occur to me, and my first impression was, that we were passing through a volume of Newcastle smoke purified by its ascent from the chimneys of Tyne-side factories. Happily this filmy shade did not shut out our view entirely, and one could still see the throng in the Cricket Ground, and gather a vague idea of the town, which, however, seemed to be turned wrong end foremost. People and terrestrial objects, animate and inanimate, became smaller and smaller; we were Brobdignagians, sailing over Lilliput. Mr. Coxwell having got now clearly into his own favourite element, having reached his realms of space, began to point out, like an agreeable host, the beauties of his domain. First, however, he seemed anxious to know the direction in which the winds of heaven were wafting us, and therefore requested us to look out for the High Level Bridge. The search for this little object was almost as hopeless as the proverbial difficulty connected with the needle in the bundle of hay; but having ranged visually about the Tyne for some time, and somewhere between Newcastle and Shields, our gaze travelled up to the Old Bridge, the dry light road of which arrested the attention. Knowing that on earth the High Level was not far removed from this, and scarcely expecting to find it turned upside down, we at length observed a black line of railway threading its course through the house-rows, and on more careful inspection, discovered the exact position of the High Level.

This was directly beneath us, and as we remained over it for several minutes, it was clear that we were not making much onward progress. Upward, not onward, was our present aim. The breeze that had rocked the "Mammoth" balloon to and fro as she swung at anchor on the green in the Cricket Ground, had been an under-current, and we seemed to have little chance of drifting far from home. Looking up the Tyne from the High Level, the Annie and Meadows Islands formed useful landmarks that could not be mistaken, and that served to aid us in comprehending our position in the clouds. But so different was the appearance of the great factories and familiar objects of the town when looked down upon, to that which they present when viewed in the ordinary way, that it was quite impossible to point out even Sir William Armstrong's ordnance sheds and yards, although the west end of Newcastle could be clearly defined. Clouds interrupted the view further west, but an opening in the light grey film floating beneath the balloon gave us an uninterrupted range eastwards.

The Tyne from Newcastle to Tynemouth was so short that the pleasant watering-place appeared to have become a close suburb of Newcastle; and had not Mr. Coxwell assured me of the fact, I should not have supposed the little town a stone's throw behind us to be the Tynemouth of one's terrestrial airings. The froth of the sea, however, as the waves broke on the shore, fringed the outline of the coast, and set the position of Tynemouth beyond cavil. From this white border the sea—apparently of darker blue than it seems from land—could be observed for a small space only before it was lost in its union with the horizon. It was satisfactory to learn that the little wind that did prevail with us drove the balloon, at all events, from the sea. We were going gently south; and on again turning the gaze to the now familiar lines of the High Level Bridge, we saw that we had crossed the Tyne, and were hanging over Gateshead, a town which does not improve in appearance when viewed from aloft. These were about the limits of our sightseeing for the present. Sounds reached our ears distinctly, and until we entered the cloud the cheers of the people we had left were audible enough. After this the puffing and whistling of steam-engines, the clang of steam hammers, and a hoarse commingling of miscellaneous noises came up from below.

The easy and imperceptible sailing of our aerial carriage was a luxury that has no parallel on earth. Perfect freedom from all resisting substance gave us something of the feeling that may be imagined to belong to a lark soaring on the wing or buoyed motionless in the air. The sense of danger was not at all strong, and any fears that might arise were checked rather than increased by the reflection that if the balloon collapsed or the ropes broke, nothing could save us. There we were, and, being there, the only thing to do was to make the best of our position. The fact of depending on a few small ropes and a bag of gas, a mile from the earth, was not, however, one that a timid person would long contemplate with any great degree of satisfaction. The only effect the ascent had upon me physically was a pressure on the ears as we passed through some of the denser clouds; but this never approached to ringing, and was not at all alarming or inconvenient. Mr. Coxwell himself experiences a similar sensation on some occasions, though not usually. The composure of the aeronaut himself was equalled by the quiet and steady application of Mr. Glaisher to his apparatus. The latter seemed indeed to be as perfectly at home as a chemist in his own laboratory; while his son, a boy of sixteen, took his notes with much more readiness and facility than I could jot down mine. This was not the first ascent of Captain Bond, who was therefore acquainted with the working of the balloon, and was both able and willing to render assistance. He and Mr. Smith, who has made

several voyages, applied themselves, under Mr. Coxwell's directions, to the throwing out of ballast when required; but first of all to the important work of disengaging the heavy iron grapnel from the car, and lowering it to the extent of a long rope. It then swung in the region below us, and served, by its inclination from the course taken by the balloon, to indicate the direction of our progress. Preliminary duty done, we refreshed ourselves with ginger-beer, and prepared to ascend higher. Mr. Coxwell directed my attention to the descent of a cork which he threw out of the car, and which could be seen descending through the space below us for several minutes after it had left his hand. Scraps of paper thrown out of the balloon served by their ascent or descent to show whether the balloon itself was ascending or descending, and we frequently had recourse to these flickering agents.

The earth seen from the height of a mile and a half presented the appearance of a vast bowl. Rivers could be distinguished and traced, towns and villages were clearly visible, but could not be identified, while cultivated lands were distinguishable by their various shades of colour, from the yellow hue of the cornfield to the brown of ploughed land and the green of the meadows and pastures. Trees appeared as low and stumpy as the hedgerows: but the sombre, solid, and massive grouping of extensive woods rendered them easily distinguished. Trains could be seen running on the lines of railway in almost all directions; and should people ever travel in balloons, and leave locomotives to convey goods only, they will assuredly believe, that with trains following so closely after each other as they appear to do when seen from above, balloons are a safer means of conveyance. The observations I have roughly recorded were the results of scarce one-tenth of the time now occupied in writing them. Turning the gaze upward, a clear blue sky overarched us; below, fleecy clouds were thickly closing in, and thus shutting out from our view all terrestrial prospects. Having passed through clouds, the effects of the sun in expanding the volume of gas, the inexpert management of which resulted in the death of Mr. Chambers at Basford, were clearly illustrated.

The balloon was swollen to its fullest extent, and from the safety-valve at the mouth of the neck the gas could be seen rushing out in a strong current. The gas thus given off did not affect the voyagers at all, nor did Mr. Coxwell, whose face was almost in the midst of it, experience any ill effects. This says a good deal for the present purity of the gas of the Newcastle Company. While the neck was open a look into the interior of the balloon was not without interest. The gas in it derived a yellowish hue from the colour of the skin of the balloon, and was so transparent that the valvular apparatus at the top could be plainly distinguished. One of those pictures of celestial beauty that well repay the risk of a balloon ascent was vouchsafed to our party. The scenes of earth had not been so varied or extensive as they frequently are; while the state of the atmosphere and the low situation of the clouds, tended to diminish what little of the picturesque belongs to the rather prosy district of Newcastle and its environs. But the scenes of the sky were truly celestial. The balloon swung in the centre of one vast and hollow globe. The concave section beneath us was composed of light grey cloud-land, as it might be termed, for the components of this substance of our world were not now separate or in groups, but united in one compact mass excluding us entirely from the earth, and rendering us for the time recognised and naturalised habitants of the sky. While in this station any apprehensions that might have been entertained when the hard earth was in sight were dissipated, and one felt as though the laws of gravitation were suspended on our behalf, and that in this world above all was rest and peace. The woolly floor beneath looked soft and yielding, and seemed siren-like to invite one to recline on its gentle slopes and find there perpetual repose.

Above our heads the noble roof of unbeclouded sky formed a vast dome to this palace of enchantment, whose gorgeous furnishings were even more splendidly imposing than was its wide expanse of ethereal space. In the far east the delicate hues of a fading rainbow streaked the azure walls. In the west the sun fringed with silver groups of clouds that shone like lurid wool. Below these a range of mountain-clouds, "the Apennines of the sky," rose peak over peak from the lowlands of our fairy country until the summit of the highest was tipped with the rays of the setting sun. Some of these hills were of rugged and rock shape, if words so hard can be justly applied to forms so soft. Others were great bold cones, and some again were rudely angled pyramids. Fitting that this glorious view of the novel realms of Nature should be contemplated with awe as well as admiration. Stillness, not indeed oppressive, but grandly imposing, reigning around. No sound of motion emanated from the softly-borne balloon, not even a creak of the car disturbed the solemn silence. Fain would we have dwelt long in such a gorgeous scene: but the weakening rays of that sun which gilded our celestial mountain-tops warned us of the claims of earth, and slowly, as we descended, the mountains seemed to rise above us; the massy expanse beneath divided first, then separated into fleecy groups, again became like filmy shades, and once more the earth burst upon our view. The temperature had varied perceptibly. At the first rising, an overcoat was a hot incumbrance. A little higher, and in the

clouds, the air was chilly, the temperature, Mr. Glaisher informed us, being twenty-nine degrees lower than in the Cricket Ground we had left. No breeze was felt, but at one time the balloon slightly varied its course, and Mr. Coxwell was not inapprehensive of a storm. Steadily we went down, and as steadily, when required, did we remount the air. "Let us just pop through these clouds," says Mr. Coxwell. The sand is poured from the bags, through the clouds we pop, and on the other side of them begin to descend. A castle surrounded by luxuriant woods and furnished with spacious gardens and well-kept lawns, is the first landmark that gives us an indication of our position. Ravensworth suggested itself to me, but on seeing that additions to the castle were in course of building, I concluded that we had reached Lambton Park, and were going towards Durham. The appearance in the distance of the Cathedral towers of that city confirmed our impressions, and on finding that we were near a line of railway, a station was pointed out, and we prepared for

THE DESCENT.

Leamside Station was on our left, and our grappling-iron was swinging so near the earth that Mr. Coxwell was apprehensive lest it should catch the telegraph-wires. Villagers for miles around had watched our flight, and we had frequently heard their cheers. They now rushed towards the descending balloon as if anxious to render assistance. Mr. Coxwell, looking out for a favourable position, thought at first to pass a range of hills right ahead of us; but finding a favourable field nearer at hand, he lowered us quickly, and warned us how to avoid injury by bumps. In accordance with his directions we cowered down in the car and, holding fast the ropes on each side, were ready for the bumps when they should come; and come they did. In avoiding the wires on the North-Eastern Railway we got out of the pan into the fire, as the phrase goes, and caught the telegraph-wires on a waggon-way that had been quite unobserved. The "Mammoth," impatient of restraint, swayed her immense bulk to and fro, and dragged most monstrously against the resistance of the grapnel on the wires. "Bravo wires!" said one, and bump went we against the ground. Up for an instant, and then down again with a bump bigger than ever, and most vilely stunning in its effects. The huge balloon flapped and tore in front of us, and suddenly carried us right off from our hold. Looking over the edge of the car, it was seen that she had torn up two of the telegraph-posts, and brought them over the hedge into the field of shorn and sheaved corn. Worse than this, an exclamation from Mr. Smith told us that the rope had broken, and that the grapnel was left hanging to the wire. Mr. Smith shouted to the peasantry who, like the Britons of old when alarmed at the appearance of Cæsar, had congregated on the adjacent heights, and requested them to come to our assistance and seize the rope.

They came down fast enough, but, not understanding what was required of them, and being perchance apprehensive of being carried off into the heavens, did not seize hold of either car or rope. Mr. Coxwell, with a degree of promptitude and energy which proved him to be equal to any danger, applied himself to the valve-rope and pulled with might and main. Nevertheless the balloon had still power to drag the car and us along the field of corn. First by slight and occasional elevations, then by regular dragging, the car lying on its side, and the monster balloon tearing along at an uncomfortable rate; Mr. Smith taking the string relieved Mr. Coxwell, and obeying his rapid orders with all his strength. Yet on we went, the car creaking and straining heavily, while we crouched in it were bumped, and knocked, and thumped, and once or twice fairly covered up with sheaves. A thick and high thorn fence was right in front of us, and it seemed likely that we should be into it. Mr. Coxwell knew better, and through his generalship and the activity and strength of Mr. Smith, aided also by our friends of the country, who had at length seized hold of the car, we pulled up just at that point where a clever hunter would have risen at the fence. The balloon, indeed, was quite over the hedge, the car still on the right side, when the people seizing the network helped to hold her back, and so saved us from a scratching.

Inquiries as to our whereabouts elicited the intelligence that we were near the village of Pittington, and that we had come to earth on the farm of Mr. Newby. The Pittingtonians male and female, old and young, gathered rapidly round, and rendered all the assistance in their power. The Rev. H. Stoker, the vicar, hospitably invited us to his manse to take refreshment, and several other gentlemen were equally kind. Mr. Newby, on hearing of the unexpected descent on his ground, hastened to Mr. Coxwell and offered to render him all the assistance he could, and to provide a horse and cart to carry the balloon to Leamside Station, a distance of rather more than two miles. Beyond the shaking, no one was injured by this unusually rough descent. The balloon was slightly damaged, and will be easily repaired. It was found that the telegraph-wires were on the waggon-way of Lady Londonderry, and though we could not ascertain that they were broken, we fear the damage may be considerable.

After the excitement had subsided, Mr. Coxwell, Mr. Glaisher and the reporter found themselves hatless, and each returned home in borrowed plumes. Master Glaisher, who has ascended six times, and thought previous ascents rather tame owing to their freedom from danger, seemed to relish the present landing as a stirring change from the monotony of his past experience. The greatest altitude attained was about two miles.

1863.—The following is the Report to the British Association, of the five most interesting ascents made by Mr. Glaisher in the course of this year:—

OBSERVING ARRANGEMENTS

were in principle the same as those of the preceding year, the only alterations made being those necessitated by the use of new instruments.

CIRCUMSTANCES OF THE ASCENTS, AND GENERAL OBSERVATIONS.

The ascents were all made by Mr. Coxwell's large balloon, as in the preceding year,—four from the Crystal Palace, Sydenham, and one from Wolverton.

*Ascent from the Crystal Palace, March* 31.—The day was favourable, the wind was from the East, in gentle motion, the sky was blue and almost cloudless. We left the earth at $4^h\ 16^m$ P.M., and passed upwards with a very nearly even motion to the height of 19,000 feet; continued above this level for some little time, and then gradually ascended to a height of 24,000 feet, which we attained at $5^h\ 28^m$, or in $1^h\ 12^m$ after starting. On opening the valve, though it seemed to be but momentary, we descended $1\frac{1}{4}$ mile in 4 minutes; this rapid descent was checked by parting with sand, and for half an hour we kept very nearly upon a level, between 15,000 and 16,000 feet high; after this we gradually and almost continually declined, and reached the earth at $6^h\ 26^m$, the descent having been accomplished in 58 minutes.

The temperature of the air was 50° on the ground, and the air was more nearly in a normal state than I had ever before seen it; almost every successive reading of the thermometer was less than the preceding in ascending, and greater on descending; the departures from these necessary conditions in a normal state were very small on this occasion. The temperature was just zero at its highest point, and 42° on the ground. There had, therefore, on the earth been a decline of 8° during the $2^h\ 10^m$ we were away; and if the numbers on the same level be compared, it will be seen that all those when descending are lower than those ascending, indicating that the whole mass of air was declining in temperature as that in immediate contact with the earth, though possibly to a less degree.

Almost free as this day was from disturbing causes, yet there existed both warm and cold currents of air.

The temperature of each layer of air was different according to its direction of motion, and there were several different currents met with. Within 2 miles of the earth the wind was East; between 2 and 3 miles high it was directly opposite, viz. West; about 3 miles it was N.E.; higher still it changed to the opposite, viz. S.W.; and about 4 miles, including the highest point, it was W.

On descending at $6^h\ 15^m$ we fell into a S.E. current, and moved towards London.

When nearly four miles high we traced the smoke from a furnace-chimney moving towards the West; after a time it turned more towards the East, then changed its direction two or three times, and finally followed us on our level.

At the greatest height the sky was of the deepest Prussian blue; the streets of London could be picked out as lines, and the squares could easily be seen, having all the appearance of an engineer's plan.

The river wound like a serpent: passing the eye down it, ships looked like little boats to beyond the Medway, where they were lost; the white cliffs of Margate were plainly seen; the sea beyond Deal and Dover was visible, but not the French coast. The coast-line was seen passing down the northern side of the Thames to Harwich and up to Yarmouth, with the sea beyond. Mr. Coxwell said he could see Ipswich. Looking South, Brighton was visible, the sea beyond, and all up to Dover; the North was obscured by clouds and mist. The West was not as clear as the East; but the sun shone on the Thames at Windsor, giving it the appearance of burnished gold.

At Putney the rippling of the water at its edges was like molten silver, and all the country within these limits was map-like, every field being distinct in the suburbs of London, gradually diminishing in size as the

distance from London increased. Greenwich Park was visible, the Observatory apparently a grey speck. We touched the ground at $6^h\ 30^m$ in a field belonging to Mr. G. Brown, Gaysthorn Hall, Barking Side, Essex.

*Ascent from the Crystal Palace, April* 18.—The balloon was partially filled during the evening of April 17, with the view of starting early the following morning. The atmosphere was at this time thick and misty; the wind on the earth was N.E.; but pilot-balloons, on attaining a moderate elevation, fell into a north current; the wind was moving at an estimated velocity of 40 miles an hour, and the ascent was delayed hour after hour in hopes that the upper current would change to N.E.

At $1^h$ P.M., when the sky was nearly covered with clouds, and there were occasional gleams of sunshine, the ascent was decided upon, although it was evident it could not be one of long duration, unless the wind should change its direction, or we crossed the Channel. Mr. Coxwell, however, did not think it prudent to attempt the latter without other and special arrangements. Whilst discussing this, the rope, our only connecting-link with the earth, broke, and at $1^h\ 17^m$ we started very unceremoniously, the balloon taking a lurch: Mr. Coxwell was partly jerked over the side of the car, and I was thrown among my instruments, and unfortunately both Daniell's and Regnault's hygrometers were broken. Within 3 minutes we were more than 3000 feet high; at 4000 feet cumulus clouds were on our level, and a thick mist rested everywhere on the earth. At $1^h\ 26^m$ we were 7000 feet high, in a thick mist which almost amounted to a fog; the temperature of the air continued at 32° nearly, whilst that of the dew-point increased several degrees; on passing out of the cloud these two temperatures very suddenly separated, the latter decreasing rapidly; the sky was of a deep blue, without a cloud on its surface.

At $1^h\ 30^m$ we were 10,000 feet high; directly under us was a sea of clouds; the towers of the Crystal Palace were visible, and by them we found we were moving South. The temperature before starting was 61°; it decreased to 32° on reaching the cloud, and continued at this reading whilst in it, then suddenly fell to 23½° on leaving the cloud, and was either less or the same at every successive reading till we reached the height of 20,000 feet, when the lowest temperature was noticed.

On passing above 4 miles the temperature increased to 14½°, and then declined to 12½° at the highest point, viz. 24,000 feet, in 1 hour and 13 minutes after starting. When we were just 4 miles high, on descending, Mr. Coxwell began to reflect that possibly we might have been moving more quickly than we expected, and that it was necessary to descend till we could see the earth; he opened the valve rather freely at $2^h\ 34^m$, and we descended a mile in 3 minutes. We descended quickly but less rapidly through the next mile, and reached the clouds at 12,000 feet from the earth at $2^h\ 42^m$. On breaking through them at $2^h\ 44^m$—still 10,000 feet from the earth—I was busy with my instruments, when I heard Mr. Coxwell exclaim, "What's that?"—he had caught sight of Beachy Head. I looked over the car, and the sea seemed to be under us. Mr. Coxwell again exclaimed, "There is not a moment to spare; we must save the land at all risks; leave the instruments." Mr. Coxwell almost hung to the valve-line, telling me to do the same, and not to mind cutting my hand. It was a bold decision, and was boldly carried out.

When a mile high the earth seemed to be quickly coming up to us, and we struck the ground at $2^h\ 48^m$, at Newhaven, very near the sea; but the balloon, by the very free use of the valve-line, was so crippled that it did not move afterwards. Nearly all the instruments were broken; and, to my great regret, three very delicate and beautiful thermometers, specially sent to me for these observations by M. A. d'Abbadie, were broken.

*Ascent from the North-Western Railway Works at Wolverton, June* 26.—In this ascent the Directors of the North-Western Railway provided the gas, and gave every facility to Members of the Committee of the British Association and their friends to be present.

The gasometers at Wolverton are too small to hold gas enough to fill the balloon, it was therefore partially inflated the night before, and remained out all night without being influenced by the slightest wind; the morning of the ascent was also calm; the sky was of a deep blue, implying the presence of but little vapour; the atmosphere was bright and clear, and all circumstances were of the most promising kind. The time of ascent was fixed to take place some little time after the express train from London should arrive, or at a little after noon; and the completion of the filling was somewhat delayed, the extraordinary fineness of the morning promising its completion in a short time. Between 11 and 12 o'clock all these favourable circumstances changed; the sky became covered with clouds, some of them of a stormy character; the wind rose and blew strongly, the balloon lurched a great deal. Much difficulty was experienced in passing the gas into the balloon, and sufficient could not be passed in by 1 o'clock. The wind was momentarily increasing, and it became very desirable to be away.

The greatest difficulty was experienced in fixing the instruments, which would have been broken but for

Mr. Negretti, who had come from London to assist me, and who protected them even at the hazard of being hurt by the violent swaying of the balloon, and the incessant striking of the car upon the ground, notwithstanding the united exertions of many men to hold it.

At the time of leaving, the spring-catch was jammed so tight by the pressure of the wind that it would not act; and we were let free by the simultaneous yielding of the men, and had to part instantly with ballast to avoid striking adjacent buildings.

It was 3$^m$ after 1$^h$ P.M. when we left the earth, with a strong W.S.W. wind. The temperature was 65°. In 4 minutes we were 4000 feet high, and entered a cloud with a temperature of 50°, experiencing a most painful feeling of cold, particularly Mr. Coxwell, who at the moment of leaving was over-heated from his great exertions, and, owing to his anxiety about the change in the weather, had left without any extra clothing. As on all previous occasions, we expected soon to break through the clouds into a flood of strong sunlight, with a beautiful blue sky, without a cloud above us, and with seas of rocky clouds below; but, on the contrary, when we emerged all looked dark both above and below; we could see the earth, but it was dark and dull, and without colour; above us there were clouds. At 9000 feet high we were both struck with a sighing, or rather *moaning of the wind*, such as precedes a storm: it was the *first time* that either Mr. Coxwell or myself had ever heard such a sound in the air. We satisfied ourselves that it was in no way attributable to any movement of the cordage about the balloon, but that it was owing to conflicting currents of air beneath. At this time we saw the sun very faintly, and momentarily expected its brilliancy to increase; but instead of this, although we were now 2 miles high, we entered a fog, losing entirely the sight of the sun; shortly afterwards fine rain fell upon us. We then entered a dry fog, passed out of it at 12,000 feet, saw the sun again faintly for a short time, and then entered a wetting fog.

At 15000 feet we were still in fog, but it was not so wetting; at 16,000 feet we entered a dry fog; at 17,000 feet saw faint gleams of the sun, and heard a train. We were now about 3 miles high; at this time we were not in cloud, but clouds were below us; others on our level at a distance, and yet more above us. We looked with astonishment at each other, and said as we were rising steadily, we surely must soon pass through them. At 17,500 feet we were again enveloped in fog, which became wetting at 18,500 feet; we left this cloud below at 19,600 feet. At 20,000 feet the sun was just visible. We were now approaching 4 miles high; dense clouds were still above us; for a space of 2000 to 3000 feet we met with no fog, but on passing above 4 miles our attention was first attracted to a dark mass of cloud, and then to another on our level; both these clouds had fringed edges; they were both nimbi. Without the slightest doubt both these dark clouds were regular rain-clouds. Whilst looking at them we again lost sight of everything, being enveloped in fog whilst passing upwards through 1000 feet. At 22,000 feet we again emerged, and were above clouds on passing above 23,000 feet. At 6 minutes to 2 o'clock we heard a railway train; the temperature here was 18°. I wished still to ascend, to find the limits of this vapour; but Mr. Coxwell said, "We are too short of sand, I cannot go higher; we must not even stop here." I was therefore most reluctantly compelled to abandon the wish, and looked searchingly around. At this highest point, in close proximity to us, were rain-clouds; below us dense fog. I was again reminded that we must not stop. With a hasty glance everywhere, above, below, around, I saw the sky nearly covered with dark clouds of a stratus character, with cirri still higher, and small spaces of blue sky between them: the blue was not the blue of 4 or 5 miles high, as I had always before seen it, but a faint blue, as seen from the earth when the air is charged with moisture.

Hastily glancing over the whole scene, there were no extensive, fine, or picturesque views, as in such situations I had always before seen. The visible area was limited; the atmosphere was murky, the clouds were confused, and the aspect everywhere dull. I cannot avoid expressing the surprise I have felt at the extraordinary power which a situation like this calls forth, when a few moments only can be devoted to note down all appearances and all circumstances, and if not so rapidly gleaned they are lost for ever. Under such circumstances, every appearance of the most trivial kind is noticed; the eye seems to become keener, the brain more active, and every sense increased in power to meet the necessities of the case; and when we look back after the lapse of time, it is wonderful how distinctly at any moment scenes so witnessed can be recalled, and made to reappear mentally in all their details.

We then began our downward journey, wondering whether we should meet the same phenomena; soon we were enveloped in fog, but passed below it when at 22,000 feet, and saw the sun faintly. At 20,000 feet we were in a wetting fog, and passed beneath it at 19,500 feet, experiencing great chilliness; fog was then above and

below. I now wished to ascend into the fog again, to check the accuracy of my readings as to its temperature, and the reality of the chill we had felt, so we reascended. The temperature rose to its previous reading, and fell again on descending. From the same level, for a thousand feet, we passed down through a thick atmosphere, but not in cloud or fog. Looking below, all was dark and disturbed; looking upwards, not much better. At the height of 18,000 feet we were again in fog. At 3 miles high we were still in fog, and on passing just below 3 miles, rain fell pattering on the balloon. This was 1 mile higher than we experienced rain on the ascent, and it was much heavier. On passing below 14,000 *we entered a snow-storm*, and for a space of nearly 5000 feet we passed through a beautiful scene. There were no flakes in the air; the snow was entirely composed of spiculæ of ice, of cross spiculæ at angles of 60° and 90°, and an innumerable number of snow-crystals, small in size but distinct, and of well-known forms, easily recognisable as they fell and remained on the coat. This unexpected circumstance of snow on a summer afternoon was all that was needed on this occasion to complete the experience of extreme heat of summer with the cold of winter within the range of a few hours. On passing below the snow, which we did when about 10,000 feet from the earth, we entered a murky atmosphere, which continued till we reached the ground; indeed so thick, misty, and murky was the lower atmosphere, that although we passed nearly over Ely Cathedral, and not far from it, we were unable to see it. When 5000 feet high we were without sand, and became simply a falling body, checked by the dexterity of Mr. Coxwell in throwing the lower part of the balloon into the shape of a parachute.

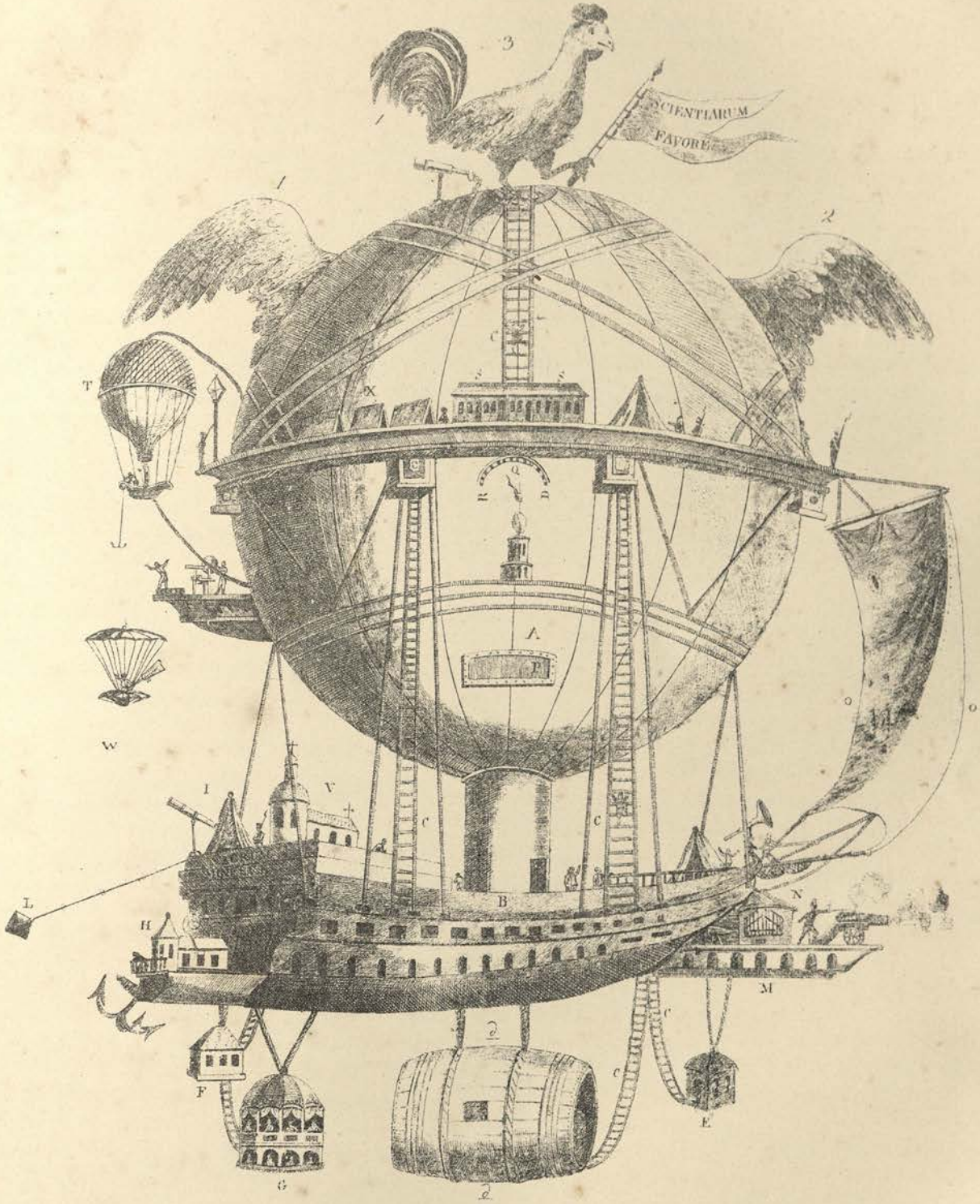
The place of descent was in a field on the borders of the counties of Cambridge and Norfolk, 20 miles from the mouth of the Wash, and 8 miles from Ely.

*Ascent from the Crystal Palace, July* 11.—This ascent was intended to have been one of extreme height; and the promise of success in this respect was held out until near the time of starting, as pilot-balloons had passed nearly due east, and indicated that our course would have been towards Devonshire; but so doubtful is the course a balloon will take that no certainty can be felt till the balloon has actually left. However, on this occasion pilot-balloons, though at first moving towards the west, soon met with a north wind, and went south. Under these circumstances the attempt to ascend five miles was abandoned, and we resolved to ascertain, as far as possible, the thickness of the stratum influenced by the east wind, to profit by the knowledge, and have as long a journey as we could.

At the time of leaving ($4^h\ 55^m$ P.M.), the sky was nearly covered with cirrus and cirrostratus clouds, and the wind was blowing due east. In about 4 minutes, and when at the height of about 2400 feet, the balloon suddenly changed from moving towards the west to moving due south. At 8 minutes past 5 we were over Croydon, at the the height of 4600 feet, in mist, but could see the Green Man Hotel, Blackheath; we then descended, passing downwards through a thick atmosphere, till, at $5^h\ 32^m$, we were 2200 feet high over Epsom Downs, and again within the influence of the east wind. We then turned to ascend, and at $5^h\ 52^m$ were 3000 feet above Reigate; here we could see Shooter's Hill and the Crystal Palace, by the two towers of which we found we were again within the influence of a north wind. We then continued to ascend, with the view of ascertaining if we could pass above the north wind; at $6^h\ 16^m$, when at 5400 feet, the wind shifted to N.N.W., and the atmosphere became very thick and misty, the sun's place being just visible. At $6^h\ 28^m$ we were 6600 feet high, and the sun was wholly obscured; we descended somewhat, but did not get below the mist. At $6^h\ 40^m$ we were 6200 feet high, and directly over Horsham.

We then ascended to 6600 feet, again to repeat the observations I had made, and found that the temperature in the half-hour had declined 2° or 3°. At this time ($6^h\ 56^m$) cirri and cirrostratus were very much higher than ourselves, and we saw the coast near Brighton.

A consultation had been held while at this height with the view of crossing over to France; but our progress being so slow, and the circumstances not promising success, we came down with the view of again falling into the east wind, supposing it still to be prevalent. We met the north wind again at about 5000 feet, and the east wind at exactly the same height, viz. 2400 feet, at which we lost it on ascending. We descended to within 1000 feet of the earth, and were near Worthing, at about 5 miles from the coast; we then ascended to 2700 feet—found ourselves moving towards the coast, and within the influence of a north wind; evidently, therefore, if we wished to continue our journey we must keep below 2400 feet, otherwise we should be blown out to sea. When again at the height of 2400 we turned to move parallel to the coast, being at this time over Arundel. Sheep in the fields were evidently very frightened, and they huddled together. We now descended to 800 feet, and thus




LA MINERVE *vaisseau aerien destine aux decouvertes par le professeur Robertson*

*Die Minerva, ein Luftschif welches durch Professor Robertson zu einer Entdekung bestimt ist*

*man sehe die Erklärung nach.*

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Belsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c. Director.*

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journeyed at heights varying from 800 to 1600 feet—villagers frequently shouting to us to come down, and now and then answering our questions as to the locality we were in. The cheering cry of children was frequently heard above other sounds. Geese, cackling and frightened, scuttled off to their farms. Pheasants crowed as they were going to roost; and as we approached the end of our journey, a pack of hounds bayed in the wildest state of excitement at the balloon.

Thus journeying, all motion seemed transferred to the landscape itself, which appeared when looking one way, to be rising and coming towards us, and when looking the other, sinking and receding from us. It was charmingly varied with parks, mansions, white roads, and, in fact, all the constituents of a rural scene of extremely beautiful character. The place of descent was Goodwood Park, the seat of the Duke of Richmond.

*Ascent from the Crystal Palace, July* 21.—The weather on this day was bad, the sky overcast and rainy. Although in every respect a thoroughly bad day, it was well suited to investigate, if possible, some points concerning the formation of rain in the clouds themselves; to determine why a much larger amount of rain is collected in a gauge near the surface of the earth than in one placed at an elevation in the same locality; whether during rain the air is saturated completely, or if not, to what extent; to discover the regulating causes of a rainfall sometimes occurring in large drops, at others in minute particles.

So long back as the years 1842 and 1843 I made many experiments in order to ascertain why so great a difference in volume was found to exist in the water collected at lower stations as compared with that collected at higher. The experiments which yielded the best results were those in relation to temperature. I always found that when the rain was warm, with respect to the temperature of the air at the time, no difference existed in the quantities of rain collected at different heights; but when the temperature of the rain was lower than the temperature of the air, a considerable difference always existed. From this circumstance it would appear probable that the difference in the quantities of rain collected at different heights is owing (at least in part) to the great condensation of the vapour in the lower atmosphere, through being in contact with the relatively cold rain.

It was also desirable to confirm, or otherwise, Mr. Green's deductions; this gentleman believing that, whenever a fall of rain happens from an overcast sky, there will invariably be found to exist another stratum of cloud at a certain elevation above the first. We left the earth at $4^h\ 52^m$ P.M., and in 10 seconds had ascended into the mist; in 20 seconds to a level with the clouds, but not through them. At the height of 1200 feet we passed out of this rain, and overlooked a range of surrounding clouds, so dazzlingly white that it was with difficulty I could read the instruments furnished with ivory scales. At the height of 2800 feet we emerged from clouds, and saw a stratum of darker cloud above; we then descended to 800 feet over the West India Docks, and saw rain falling heavily upon the earth. None was falling upon the balloon; that which we saw, therefore, had its origin within 800 feet of the ground; we ascended again, and this time passed upwards through fog 1400 feet in thickness. At 3300 feet we passed out of cloud, and again saw the dark stratum at a distance above; clouds obscured the earth below. On descending, at 2700 feet we entered a dry fog, but it became wetting 100 feet lower down. After passing through 600 feet the clouds became more and more wetting, and below were intensely black. At $5^h\ 28^m$ we were about 700 feet high, or about 500 feet above Epping Forest, and heard the noise of the rain pattering upon the trees. Again we ascended to 2000 feet, and then descended, passing into squalls of rain and wind at the height of 500 feet, with rain-drops increasing in size as we descended, till they were as large as a fourpenny-piece, those on reaching the ground being of the same size as when we left it. On descending we found rain had been falling heavily all the time we were in the air. [Mr. Green's deduction is therefore confirmed by this experiment.]

The following description of "Le Géant" of M. Nadar, is extracted from 'L'Aéronaute,' a periodical started by him, to promote the interests of aerial navigation. His balloon was for some time exhibited at the Crystal Palace:—

THE GIANT BALLOON.

Several persons who do not follow from day to day the columns of the newspapers, have asked me, "But why do you make a balloon, you who affirm with such assurance that the first condition, in order to move oneself in the air, is to suppress balloons, and that in order to contend against the air, it is necessary to be heavier, and not lighter than the air?"

To these people I reply, I have profound faith that the screw will be our aerial motor; but I am ignorant of what the experiments of this first motor will cost.

I have no great merit of intuition in suspecting that it will always be necessary to commence with something —twenty thousand pounds or four hundred thousand pounds!

Now, if I had bethought myself of going and holding out my hand to the public, to demand a small million in order to *experiment*, to make, *perhaps*, a machine that *will try* to fly in the air, the public would not have failed to utter cries of alarm, and those who do not care to look on, those who cannot see, those who, above all, hold by their sovereigns, would have cried out in chorus, "This man is certainly a madman! We were somewhat doubtful until the present, but here he makes open confession of it. What! He has the coolness to ask us for a million in order to . . . . . .
He is an impertinent fellow, who makes fun of us!" They would have abused me with their tongues, which is more economical than untying the purse-strings; and some, in the greatest hurry not to put their hands in their pockets, would have treated me, at least, as a thief.

As I do not like to ask, and as I do not intend to allow any one the possibility of not passing very obliging judgments on my account, I said to myself that I would give myself the first million, the first hundred thousand francs, if you will, to my dear screw.

And as I had not this million precisely under my hand, I have resolved to procure them for myself by means of a spectacle always irresistible. I shall make a balloon—the *last balloon*—in proportions extraordinarily gigantic, twenty times larger than the largest, which shall realise that which has never been but a dream in the American journals, which shall attract, in France, England, and America, the crowds always ready to run to witness the most insignificant ascent. In order to add further to the interest of the spectacle—which, I declare beforehand, without fear of being belied, shall be the most beautiful spectacle which it has ever been given to man to contemplate—I shall dispose under this monster balloon a small balloon (*balloneau*), destined to receive and preserve the excess of gas produced by dilatation, instead of losing this excess, which has hitherto been the case, which will permit my balloon to undertake veritable long voyages, instead of remaining in the air two or three hours only, like our predecessors.* I do not wish to ask anything of any one, nor of the State to aid me, even in this question of general and also of such immense interest. I shall endeavour to furnish myself the two hundred thousand francs necessary for the construction of my balloon; and the said balloon finished, and by public ascents and successive exhibitions at Paris, London, Brussels, Vienna, Baden, Berlin, New York, and everywhere, I know beforehand that I shall collect the first funds necessary for the construction of our first aeromotive.

The balloon can only therefore be, and is only, but the prologue; the true piece is the aeromotive, which supersedes the balloon.

I have set to work immediately, and after many difficulties and vexations, which I have kept to myself alone to this hour, I have succeeded in establishing my balloon, in founding at the same time this journal—this indispensable *Moniteur* to the aerial automotive; and in laying the basis of that which shall be, perhaps, the greatest financial operation of the age.

However, if I demand nothing of any one, I had about me brave and good friends, who, having at first dissuaded me, finished by accepting my will, although it was so absolute, and by aiding me with all their powers. I wish, I repeat, to relate all this when our more pressing business shall be finished. It is by this active intervention of those about me, who have been pleased to render me the affection which I have for them, that I have been able to obtain from the Administration, without even, so to speak, having had to ask for it, the place necessary for my first ascents.

This little explanation finished, I arrive at the description of our "Giant."

The "Giant" is composed—

1. Of two balloons, one within the other, for greater strength, of white silk of the first quality, and absolutely identical. Each of these balloons has 118 gores of forty-five metres in length, which gives a

* The first idea of a compensator belongs to Louis Godard. I have limited myself to making the practice of it more easy, by placing the small balloon in the vertical, which he disposed laterally against the large balloon, and whose non-automatic management was hence less simple.

circumference of ninety metres (one metre equal to $39\frac{3}{100}$ English inches). These gores are entirely hand-sewn, with a double seam.

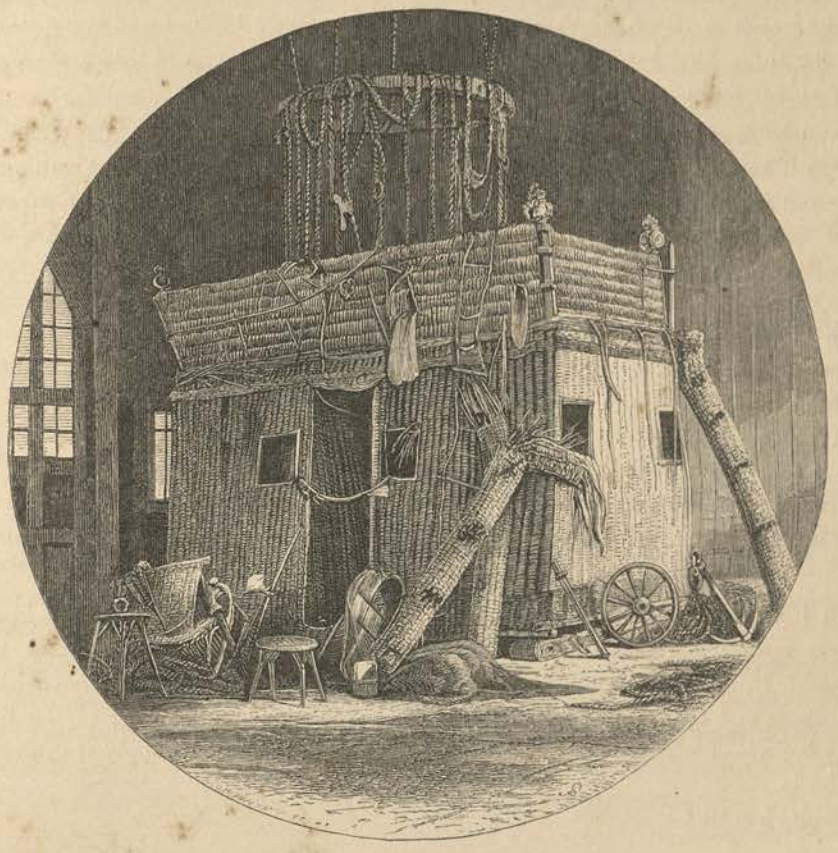
2. Of a small balloon, called *compensator*, placed beneath the first double balloon, to receive the excess of gas, and which gauges only 100 metres (3531 cubic feet).

The "Giant" can and ought to raise a weight of 90 quintals ($4\frac{1}{2}$ tons).

The total height of the entire machine attains, if it does not exceed, 60 metres (196 ft.), 14 metres (45 ft.) less than the towers of Nôtre Dame.

Its construction employed 20,000 metres (22,000 yds.) of silk, at about 5*s.* 4*d.* per yard.

The car has two floors (ground-floor and platforms). Its height and breadth are 2 metres 20 centimetres by 4 metres. These dimensions, which are somewhat rigorous in face of the weight the aerostat ought to carry up,



Car of Nadar's Balloon.

have been imposed by the necessities of the return. The car had to be reduced to the strict proportions of the gauge of a railway, so as to be able to be transported by rail. The hand-rails of the platform fold down upon it, in the return.

It is constructed of ash-branches, ratans, and osiers, traversed beneath and on its walls by twenty cables, interlacing their fabric, which are attached to the hoop.

4. It is carried upon two axles and four wheels, which are fitted on after the descent, which gives us every facility of returning, supposing a descent far from the centres of population. Canes disposed to act as springs are placed underneath and round the middle to protect the car from concussions. Besides internal buoys, an immense girdle in compartments, of inflated india-rubber, defends it against every possible immersion. The ground-floor contains a cruciform passage and six divisions. At the two extremities—on the one part the cabin of the captain, with a bed seventy-five centimetres in breadth, and underneath a compartment for luggage; on the other a cabin for passengers, three beds, one above the other, of sixty centimetres.

The four other divisions are intended for—1, provisions; 2, a lavatory; 3, photography; * 4, printing press.

We shall take up with us Raguenaut's small lithographic press, which will be more than sufficient for printing off the abridged account of our expeditions, to distribute above localities which we pass over.

Regarding this, an English company a month ago—our neighbours are marvellous in not losing time—appreciating the bustle which the sight of a balloon excites in every inhabited place, and judging rightly that papers would never be better received and more greedily read than those thrown overboard by us—despatched to me a messenger, to propose to me to accept in like manner commercial prospectuses. We shall never have too much money for the construction of our first aeromotive. I have accepted and made a contract.

To return to the description of our "Giant." It is useless to add that we have endeavoured to forget nothing calculated to assure the wellbeing and security of our excursions—provisions of all sorts, instruments for scientific observations, games, means of defence in case of descent among an inhospitable people, and even to two cages of carrying-pigeons sent from Liége.

It only remains for me to return my thanks to my numerous fellow-labourers of every rank, whose extreme willingness to aid me throughout has alone enabled me to arrive at the end of this great work in the time I thought I should be able to do so.

| | |
|---|---|
| Superintendence of Works .. .. .. .. | MM. Louis & Jules Godard. |
| Geometrical Draughts .. .. .. .. .. | MM. Tisseron & Abeillon. |
| Cutting and Sewing .. .. .. .. .. | Mme. Louis Godard, superintendent. |
| Car and Wickerwork .. .. .. .. .. | M. Fortuné. |
| Hoopwork .. .. .. .. .. .. .. | M. Guillaud. |
| Joinery, Valve .. .. .. .. .. .. | M. Laurain. |
| Varnish .. .. .. .. .. .. .. | M. Leleu. |
| India-rubber and Bedding .. .. .. .. | M. Guibal. |
| Barometers .. .. .. .. .. .. | MM. Richard & Breguet. |
| Optical Instruments .. .. .. .. .. | M. Richebourg. |
| Rifles .. .. .. .. .. .. .. | M. Devismes. |
| Decorations and Equipment .. .. .. .. | M. Godillot (Delessert & Co.) |

The firm of Fantin, Thirion, and Daydon, has supplied us in two hours with the required 20,000 metres of silk.

When I shall have thanked after these, which I most heartily do, the humble workpeople, 300 women and men, for their modest and indefatigable day and night labours during this painful month, it will be permitted me to add, to leave nothing behind, that the firm of Potel and Chabot have kindly presented us with all their products, and that more kindly still, if that is possible, the Director of the firm Courmeaux has already sent us six baskets of wine of the first quality,—and even Siraudin, a supply of confectionary enough for three boarding-schools.

I have finished—Let Go! NADAR.

The first ascent of Nadar's "Géant" was made on the 4th October, from the Champ de Mars:—

The whole plain was filled by spectators, anxious to see the departure of the aeronaut and his companions. The balloon, when inflated, was exactly fourteen yards lower than the tower of Nôtre Dame.

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* We are not about to amuse ourselves, as one may well suppose, in making portraits in the air. The balloon "le Géant" will be employed in various works of *aerostatic photography*, for which I was the first to take patents in France and abroad seven years ago, and the results of which will be so valuable for all planispheric, cadastral, strategical, and other surveys. M. Negretti, the celebrated optician of London, has obtained this year, according to what has been stated, some beautiful negatives, of which it affords me great pleasure to hear, since it has ended in demonstrating experimentally that *I was right*. I shall only permit myself to observe to M. Negretti, that he deceives himself in claiming *priority*. The dates of my patents prove it, on the one hand; and besides, I have myself obtained, in spite of most detestable materials, results (a simple positive upon glass, it is true), above the valley of the Bievre, at the beginning of the winter in 1858. If I have not made any claim against the assertions contained in the two letters of MM. Simon, of the Greenwich Observatory, and Negretti, published successively in the 'Daily Telegraph,' it is only because I had not time. But I do not at all mean that there should be prescription in that case.

Of course, such an unusual event was calculated to have its records in the various European journals. We cannot quote the whole of the reports, valuable as they are from having been written by eyewitnesses, and will limit ourselves to a few of the more important.

'Galignani' writes thus:—

"The departure of this Leviathan of the airy regions attracted immense crowds to the Champ de Mars, yesterday afternoon. Considering that the avenues encircling that vast space were filled to suffocation, so that we found it extremely difficult to force our way to the open ground reserved for tickets, and that all the house-tops were occupied by spectators, we think the number of persons present may fairly be stated at 80,000. Ample precautions had been taken to prevent disasters; a strong police force, supported by a company of infantry and some cavalry, being present to maintain order. The balloon, which is ninety yards in circumference, and has consumed upwards of 20,000 yards of silk in its manufacture, was held down, while filling, by about 100 men, and the weight of at least 200 sandbags. The car was of wickerwork, comprising an inner surface of about fifty-four square feet divided into three compartments, or small rooms, surmounted by an open terrace, to which the balloon was braced. Outside, grapnels, wheels, and fowling-pieces, four of each, besides two speaking-trumpets, were lashed to the sides of the car. The wheels were intended to be put to the car after alighting, in order to convey it back with horses. The preliminary operations took considerable time, putting the patience of the spectators to a severe trial,—a circumstance which perhaps prevented them from cheering when the words '*Lâchez tout!*' were given, and the immense machine rose slowly and majestically into the air.

"We were rather surprised at the silence of the public, considering the very remarkable feat in aeronautics thus successfully performed. There were fifteen persons in the car, or rather cabin—M. Nadar, captain; MM. Marcel, Louis and Jules Godard, lieutenants; the Prince de Sayn-Wittgenstein, Count de St. Martin, M. Tournachon (Nadar's brother), MM. Eugène Delessert, Thirion, Piallat, Robert Mitchell, Gabriel Morris, Paul de St. Victor, De Villemessant, and one lady, the Princess de la Tour d'Auvergne. The Princess was taking her usual drive to the Bois de Boulogne, when, observing an unusual movement in the neighbourhood of the Invalides, and having inquired the cause, she ordered her coachman to drive to the Champ de Mars. Having seen the balloon, she expressed a wish to make the ascent, and although Nadar had to the last moment refused to take any lady, and even his own wife, he could not resist the entreaty of the Princess. On starting, M. Nadar climbed up the network and took off his hat to the spectators. The balloon took a north-easterly direction, and was visible for some time. At the moment of going to press, a communication has reached us signed by the captain, M. Nadar, and all those who had taken places in the balloon, stating that on alighting yesterday evening at nine o'clock, at Barcy, near Meaux (Seine-et-Marne), three severe shocks were experienced, which had the effect of completely capsizing the balloon, and inflicting on its occupants several rather severe contusions.

"Interesting details of the ascent of the Nadar balloon, said to have been narrated by Prince Wittgenstein, are given by the 'France.' The most extraordinary is, that at half-past eight, when the balloon attained the height of 1500 metres, the aeronauts saw the sun, which had set for the earth below upwards of two hours before. The effect of the light upon the balloon is described as something marvellous, and as having thrown the travellers into a sort of ecstasy. Although they met with no rain, their clothes were all dripping wet from the mist which they passed through. The descent was more perilous than at first reported. The car dragged on its side for nearly a mile, and the passengers took refuge in the ropes, to which they clung. Several were considerably bruised—though, as before stated, no one sustained any very serious injury. Everybody behaved well. Nadar, visibly uneasy about his fair charge, the young Princess de la Tour d'Auvergne, was told by her to attend to his duty as captain. 'Every one at his post,' said she, 'I will keep to mine.' Notwithstanding all the shaking which the car underwent, the thirty-seven bottles of wine provided for the journey were all found unbroken, and they were most joyously broached when the party got on *terra firma*. The rifles, the crockery, as well as a cake and thirteen ices, presented to Nadar by Siraudin, of the Rue de la Paix, were all uninjured. When the descent was effected, the lights and the speaking-trumpets soon attracted a number of peasants, who brought carts and helped the party to the village of Barcy, where most of them passed the night; but M. Nadar and the Prince de Wittgenstein, with two or three others, came to Paris by the first train from Meaux. It is said that the descent was resolved upon in consequence of the advice of the brothers Godard, and contrary to the wish of M. Nadar, who, as captain, had made every one of his companions sign an agreement to act upon his orders, even though the vote should be unanimously against him. He, however, yielded his opinion, in deference to that of these experienced aeronauts.

A truly extraordinary statement is, that they fancied the wind was blowing them to the sea, and certain destruction, whereas they were going due east, with no sea at all before them nearer than the Caspian.

"There was great disappointment in the receipts at the Champ de Mars, which are said to have realised only 27,000f., whereas 150,000f. had been calculated upon. The papers say that the public broke down the barriers and got in for nothing, instead of paying their franc. It is quite certain that at the moment of the ascent there could not have been less than 50,000 people on the Champ de Mars, and on the terraces and heights around there must have been four times that number."

Before proceeding further, we may just quote the rules laid down by M. Nadar for his first ascent. Circumstances have not allowed them to be carried out to their full extent. The rules have not yet appeared in any English journal. We extract them from the 'Moniteur,' which published on the day after the ascent a very clever article from the pen of M. Gustave Claudin.

"1. Every traveller on board the 'Géant' must take, before mounting, knowledge of the present rules, and engages himself upon his honour to respect them and to make them respected, both in the letter and in the spirit. He accepts and will obey this obligation until the descent.

"2. From the departure to the return there shall be only one command, that of the captain. That command shall be absolute.

"3. As legal penalty cannot be enforced, the captain, having the responsibility of the lives of the passengers decides alone, and without appeal, in all circumstances the means of assuring the execution of his orders with the aid of all under him. The captain can, in certain cases, take the advice of the crew, but his own authority is decisive.

"4. Every passenger declares, at the time of ascending, that he carries with him no inflammable materials.

"5. Every passenger accepts, by his simple presence on board, his entire part and perfect co-operation in all manœuvres, and submits himself to all the necessities of the service; above all, to the command of the captain. On landing, he must not quit the balloon without permission duly acquired.

"6. Silence must be absolutely observed when ordered by the captain.

"7. Victuals and liquors carried up by the travellers must be deposited in the common canteen, of which the captain alone has the key, and who regulates the distribution thereof. Passengers have no claim to victuals and liquors except when on board.

"8. The duration of the journey is not limited. The captain alone decides the limitation; the same judgment decides, without appeal, the putting down of one or more travellers in the course of the voyage.

"9. All gambling is expressly prohibited.

"10. It is absolutely forbidden to any traveller to throw overboard ballast or any packet whatever.

"11. No passenger can carry up with him luggage exceeding 30 lbs. in weight, and occupying more space than an ordinary travelling-bag.

"12. Except in very rare cases, of which the captain alone shall be judge, it is absolutely forbidden to smoke on board, or on land within the vicinity of the balloon."

Of course, various opinions have been expressed by the English journals on this aerial voyage. The interest in England was general. There were suspicions in the English mind that the French navigator could not rival the aeronauts of England. There were prophecies of disaster. The ascent was made, however, but under special disadvantages, as many of the details of the project were new, and the public has not yet been made acquainted with all the ingenious devices of M. Nadar. There was sympathy for the aeronaut, but in the English journals, which in matters of science did not represent the English mind so completely as in matters of politics, adverse judgment has been given against many of them. Sneers and jests are not arguments.

"Sunt verba et voces, prætereaque nihil."

We approve, however, of the tone in which the 'Morning Post' writes:—

"The Champ de Mars yesterday was occupied by a crowd of not less than 100,000 persons, of all classes of society, to witness the ascent of the largest balloon ever yet constructed, with the novelty of a small square house instead of the ordinary car. The newspapers have for some time contained accounts of the 'Géant,' and scientific papers have been read on the 'Giant's' power to navigate the air, and carry a heavier weight than has hitherto sailed through the cloud world. The public, therefore, were worked up to an excited pitch; and as the first

'trip' of the balloon took place on Sunday, a most numerous mob of spectators not only covered the immense space of the military review-ground, but blackened the house-tops, and crowded every approach to the Champ de Mars. The weather was favourable, without rain, the sky being covered, so that the upturned eyes of the thousands could gaze at the inflated leviathan without inconvenience. The "Giant' is made of yellowish white silk, and presents the usual graceful form. M. Nadar, the presiding aeronaut, in giving the statistics, says that it is ninety yards in circumference, and consumed 20,000 metres of silk. We are told that the larger class of balloons have generally contained about 2500 metres of gas, whilst the new 'Giant' holds 6098 metres. The car, of wickerwork, is a square construction, on the roof of which the passenger stands, as on the deck of a vessel.

"Below is a first and second floor, with saloon, a compartment for scientific instruments, three cabins for repose, and provision and baggage compartments. Outside, round the house, were grapnels, wheels, and fowling-pieces, besides two speaking-trumpets, and provisions. The wheels were intended to be put to the car after alighting, in order to convey it back with horses. In fact, one might suppose that the travellers expected to descend in some wild distant land, where no food could be obtained. However, all this 'get-up' pleased the French amazingly, and formed the subject for conversation as the 'Giant' heaved and rolled about, and gave signs of anxiety to be off. Military bands enlivened the crowd until four o'clock, when MM. Nadar and Godard, aeronauts, received the passengers, amongst whom was a lady in a pretty hat and ordinary morning toilette. This was the romantic event of the day. The Princess de la Tour d'Auvergne, whilst driving in the Champs Elysées, was suddenly seized with a desire to take a sail in the regions of air, and accordingly presented herself as a passenger. M. Nadar refused for some time; but, of course, the fair Princess eventually prevailed, as all clever women do, and was admitted to the car.

"The travellers on this extraordinary occasion ought to appear, perhaps, amongst the 'departures' in the fashionable columns of the 'Morning Post.' We may, therefore, say that on Sunday last the following nobility and gentry left this earth (destiny unknown):—M. Nadar, captain; MM. Louis and Jules Godard, Marcel, lieutenants; Tournachon, Prince de Sayn-Wittgenstein, Comte de Saint-Martin, Eugène Delessert, Thirion, Piallat, Robert Mitchell (newspaper reporter), Gabriel Morris, Paul de Saint-Victor, de Villemessant, and the Princess de la Tour d'Auvergne. When fireworks are let off, and a balloon leaves the earth, no matter in what country, the crowd make use of the same expressive, wonderful (O-o-o-o-o-o!) All eyes are upturned, many a mouth opens, and a stupid expression generally possesses the most intelligent face. All this took place as the 'Giant' ascended from the Champ de Mars, and slowly sailed off in an easterly direction, growing smaller and smaller, as balloons do—in fact, as 'it is their nature to.' The crowd then dispersed quietly. There was no drunkenness, no swearing. Might not a Sunday afternoon be worse spent? It was in the year 1783 that Montgolfier first astonished the Parisians and the Court of Versailles with an ascent in a balloon filled by hydrogen gas.

"The inflammable nature of this gas rendered it a most dangerous experiment, and it was not until the general employment of the ordinary illuminating gas that aeronauts ventured on the airy voyages which are now so common. Garnerin was the first person who made an aerial voyage in London, on which occasion the whole population poured out to wonder at this remarkable event. It has been said that his Majesty George III. was holding a Cabinet Council at St. James's, when the attention of his advisers was directed to the movements of a balloon. His Majesty went to the window, observing that he knew the people in France often made themselves fools, but he thought his subjects in England were wiser than to attempt or patronise such hazardous experiments. The brothers Garnerin were the first who descended in a parachute. Eliza Garnerin, daughter of the aeronaut, was the first female who ventured to quit the balloon in the frail parachute, and afterwards performed the perilous experiment no less than thirty-nine times. It has been supposed that the first time a balloon was employed to assist in the art of war was in the late campaign in Italy, when the Emperor Napoleon III. availed himself of it for surveying purposes. His great uncle, however, considered that the balloon might be rendered useful; and it had been employed at the battle of Fleurs to watch the movements of the enemy. Pilâtre de Rozier attempted to cross the Channel in 1785, but he unfortunately had made use of hydrogen gas, which took fire, the balloon exploding, and he was dashed to the earth and killed upon the spot. A monument has been erected to his memory at Boulogne. The famous Nassau balloon made, some years since, a sail across the Channel, and was the wonder of the day, the aerial voyage lasting many hours. A journal has appeared in Paris called 'L'Aéronaute,' which, in future, is to record the latest scientific intelligence from the high heavens. In fact, the 'Giant' promises to inaugurate a new era in the art of navigating the air."

Nadar, on his return to Paris, wrote briefly thus :—

"Paris, Oct. 5.

"Here, as briefly as possible, is the account which you asked me to send. Yesterday evening, at nine o'clock, the 'Giant' was compelled to descend near the Barcy Marsh, two leagues from Meaux, after three violent shocks, the last of which completely turned everything in the car topsyturvy, and it descended on its side. The rupture of our valve-pipe rope, while travelling by night, forced us to throw out our anchors. One of the prongs of the first anchor having broken, the principal anchor fortunately took hold of the ground. We were able to let out the gas, notwithstanding the violence of the wind, and the car was set up at half-past one in the morning. Some slight contusions and a concussion of the knee of one of the passengers—that is our receipt in full. It is not too dear.

"(Signed) A. NADAR."

This short account was followed afterwards by a more detailed statement, which we give :—

"Allow me to add some explanatory details which appear to me to be necessary. My principal anxiety was, whether the double covering of silk, supported by the network, would be strong enough to bear the terrible pressure of 6098 metres of gas. There had never before been any experiment made in those proportions, except that of the famous 'City of New York,' which burst like a bomb before it went up. I do not speak of other secondary difficulties in an operation of such considerable proportions and of such a novel character. Those multiplied difficulties prevented us from starting until five instead of four, and then without having time to attach the compensating balloon, which would have required another hour. For some of the spectators it is, perhaps, well to add, that the interest of the spectacle did not lose much, as they would only have seen the balloon look a little longer, and not quite filled. The compensating balloon is, in fact, only a prolongation of the other, and would fill when the gas in the larger one dilated. The name it bears sufficiently shows the purpose for which it was intended. I have been informed that some of the spectators calculated on seeing the balloon steered; this is an additional proof that the same thing cannot be too often repeated.

"It nevertheless appeared to me that all the journals had at great length explained that the theory of the steering of balloons was an absurdity; that to contend against the air it was necessary to decide on being like a bird, heavier, and not lighter than the air; that the screw appeared to solve the problem; that, in order to make the costly experiment of a first aeromotive in practical proportions, I had resolved to procure the necessary resources, not by a public subscription, but by a spectacle interesting enough to secure the desired result; that I had, as the first subscriber to the screw which will conduct us in the air, incurred at my own risk and peril the expense of this gigantic balloon, which will, I hope, be the last; that this balloon is not, therefore, an object, but a means; not the piece, but the prologue.

"I am willing, for the benefit of my beloved screw, to pledge myself to risk my bones as many times as may be necessary, but as to steering balloons, never! Many persons were not able to enter the ground for want of a sufficient number of paying-places. Those persons might have secured tickets, which were to be had two days before all over Paris. This does not prevent me from offering them my excuses, begging their indulgence for an unskilled director of spectacles, who is the first to suffer from their non-admission. Some of the spectators, I am told, also complain that the reserved enclosure had no seats provided. I am not aware that chairs were ever placed in the Champ de Mars for any public exhibition, any more than at Longchamps or at Vincennes. I thought I was doing a great deal in placing 2000 metres of seats for the ladies who first entered. The posting-bills and tickets did not promise that. In order to satisfy every one, I shall endeavour to have seats for the second ascent, which will take place on the 18th inst.

"NADAR."

Nothing daunted by the accident already explained, M. Nadar made another ascent on the 18th of October. Again the ascent was made from the Champ de Mars; the Emperor and the young King of Greece being present. The Emperor manifested a special interest in the enterprise, and remained on the ground until the balloon had left *terra firma* and soared into the skies.

The first news that reached England was a telegram to the following effect, dated Paris, 18 October, 6.45 P.M. :—

"Monsieur Nadar made a most successful ascent in his giant balloon at five o'clock, from the Champ de Mars. The Emperor, the King of Greece, and a vast crowd witnessed the ascent. The Champ de Mars was kept by the military. Nine ladies and gentlemen ascended in the balloon, but it first made a short ascension with thirty-two persons."

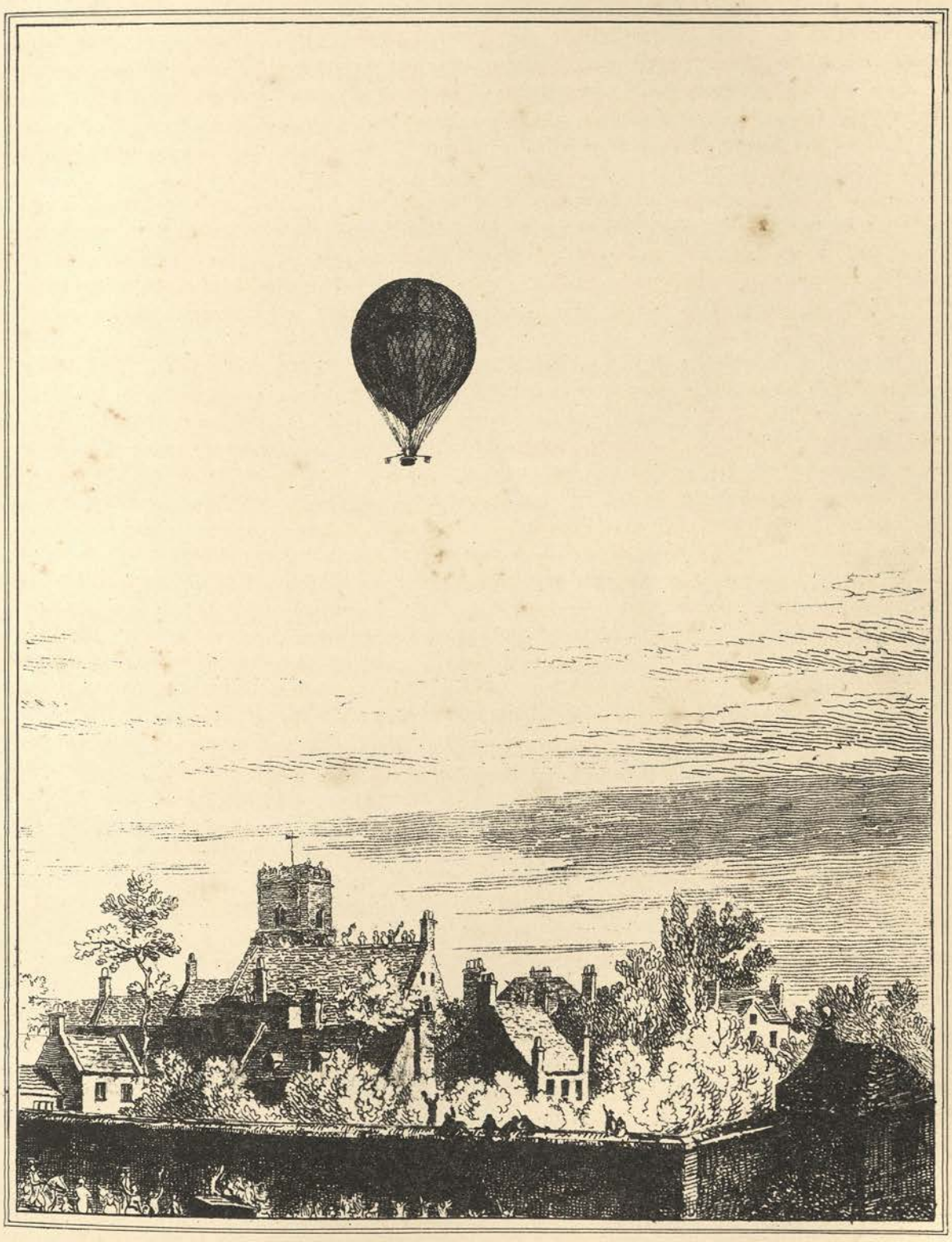

Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director

The excitement of the Parisian public, of course, was great, and all the representatives of the French and foreign journals were present to witness what was passing, and to transmit their impressions to their respective papers. To quote all that was written to English and Continental newspapers would be superfluous. We give, then, a few of those which reached London on the Tuesday following, and which were read with avidity by all classes of the community. We take, to begin with, the 'Daily Telegraph,' who dates—

"Paris, Sunday Night.

"M. Nadar made his second ascent to-day at 5 P.M. I told you last time that all Paris was present. To-day Paris must have invited all its country cousins to the last degree, and they must all have accepted the invitation. I have never seen here so dense a mass of people as were crowded round the Champ de Mars. The Emperor was present for nearly two hours before the balloon started. He arrived in a simple open carriage and four, and an aide-de-camp in the carriage, and an 'equerry and two outriders with it. When he entered the Champ de Mars he ordered the postilions to walk their horses, and entered the ground at foot-pace. He was looking extremely well, and was more warmly received than I have ever seen him by his own subjects. The Emperor had a long conversation with M. Nadar, and examined everything, from the car to the ropes which held the machine to earth.

"The 'trial' or 'contrast' balloon was the Godillot, used in the Italian campaign, and the Emperor watched with a very natural interest a sort of ascent in 'leading-strings' made by this smaller balloon, which rose high enough to enable maps of any enemy's position to be taken without leaving head-quarters. Just as the Emperor had finished his inspection arrived the young King of the Greeks, and he also examined everything, and even entered the car after it was attached to the globe. Imagine if the ropes had given way, and George I. had been wafted to Greece, unattended, in a balloon! Another great man was present—Meyerbeer. After an experimental rise of about 100 yards, with twenty-seven men on board, the 'Géant' returned to earth, and proceeded to prepare for the real start. I think there were only eight first-class passengers, and, this time, no princesses. At 5.10 P.M. 'Le Géant' ascended, with a strong north-westerly wind, the little Godillot fluttering up by its side."

It was only natural, that after the balloon had left the Champ de Mars, and disappeared in the shades of night, that much anxiety should be felt as to the course the balloon and its living freight had taken. Of course, speculation was rife. Some talked of England; some of Belgium; some of Moscow, or even Siberia. Inquiries were made at the house of M. Nadar, in the course of the following day, by parties interested in his project, and more than that, in the safety of himself and his friends. The Emperor himself, who had shown so much sympathy and interest in the ascent, sent repeated messengers to ascertain whether any news respecting the "Giant" had reached Paris.

The greatest uncertainty existed, and anxiety prevailed until the afternoon of Monday, when a telegram was received that at half-past eight on the previous evening Nadar was over Compiègne, seventy-eight miles from Paris. He sent a message down, "All goes well," and continued his journey towards the north, having descended near the ground to speak.

Nothing more was heard of the balloon until a second telegram was received in Paris, stating that Nadar's Giant Balloon passed over Erquelines, on the Belgian frontier, at midnight on Sunday. The aerostat was moving not far from the ground, and the customs' officers called out to know if the aerial voyagers had anything on which duty should be paid! No attention was paid to the question, and the balloon kept on its course towards the German frontier.

Meanwhile curious Parisians flocked to M. Nadar's home to ascertain if any further tidings had been received. It was hoped he had not foundered in the German Ocean; it was then forty-eight hours since this dangerous navigation had commenced, and so long a sojourn in the clouds was believed to be unprecedented in aerostatic annals.

At last came a telegram from Bremen, dated the 21st:—

"Nadar's balloon descended near Eystrup, in Hanover. There were nine persons in it, of whom three were seriously and two slightly injured."

Other telegrams were published in Paris shortly afterwards, and also circulated in London, where the interest taken in Nadar's ascent was as great as that in Paris. Here follow two of them:—

"Paris, Oct. 21.

"We descended near Nienburg, in Hanover, at noon on Monday. Our balloon was dragged for several

hours, the anchors having been broken. St. Felix, my wife, and I, are rather seriously hurt; the others are better. We owe our lives to the courage of Jules Godard. More detailed news to-morrow."

"Hanover, Oct. 21.

"The wounded persons from M. Nadar's balloon have been conveyed to this city, and placed under the care of the French Legation. The King of Hanover sent an aide-de-camp to inquire after their wants. M. St. Felix has sustained a fracture of the left humerus, besides contusions on the face. M. Nadar has both legs dislocated. Madame Nadar has sustained a compression of the thorax and contusions on the leg."

That an accident had happened was manifest from the tenor of these various telegrams, and the greatest anxiety prevailed to have a fuller account of the voyage of Nadar and his companions, and the nature of the injuries they sustained. At this moment English curiosity was exceeded by English sympathy. It had been stated that two medical men had been summoned from Paris to attend the wounded, and that Dr. Richard had actually left for Hanover, taking with him the young son of Nadar. Dr. Richard took the telegraphic despatch to serve as a passport. It was stated that the travellers would probably have all perished if Jules Godard had not, at the risk of his life, climbed up by the network and cut a hole in the silk with a hatchet, so as to allow the gas to escape. By so doing he stopped the furious course of the balloon, which was making bounds of from forty to fifty yards, with a violence that would soon have knocked the car to pieces. A despatch received at a later hour stated that M. and Madame Nadar, whose injuries are not so serious as at first stated, were going on well, as was also M. St. Felix.

Details at last began to arrive of the ascent and descent, although as yet they did not enter much into particulars. The 'Northern Gazette' of Hanover published the following letter:—

"Nienburg, Oct. 19.

"At a quarter-past nine this morning a large balloon passed over this town, coming from the left bank of the Weser, with the wind at south-west. The lower part of it appeared to be emptied of its gas, and was moving about within the network which surrounded it. It passed at a height very little above the houses, and the persons who were visible in the car appeared to have the intention of descending, for when the balloon passed over the railway a grapnel was thrown out, but did not quite reach the ground, and the workmen on the line who ran to the spot could not succeed in laying hold of it. The balloon then rose and went in the direction of the village of Wœlpe, which is surrounded by marshes. Another grapnel fell on the roof of a small summer-house, but did not find a solid hold, and tore away one of the rafters. The balloon afterwards struck against the house of the watchman of the railway station at Nienhof, and against the telegraphic wires, which nearly turned it over. The car was dragged along the ground for a length of time, the persons in it calling for assistance, which could not be given to them, by catching hold of the ropes which hung from the car, the wind being too high. When near Wœlpe the balloon rose high enough to pass over the trees and to proceed in the direction of the desert countries of Lichtenmoor and Rolhem. Since that time no accounts have been received of the unfortunate persons in the car. Several ropes fell during the violent plunges which it made, and also two large pieces of iron seeming to be axle-trees, and a speaking-trumpet. Every one asked where did the balloon come from—from Paris or the Rhine, but as a hat was also found which had been purchased on the Boulevard Sebastopol at Paris, the probability is that the aeronauts are Parisians."

It is as if we were writing of some great battle, so various and sometimes so conflicting are the accounts which reached us. This circumstance, however, only proves the great curiosity which was everywhere manifested respecting the balloon, and the great interest taken in its fate. Special reporters were sent by some of the German papers to the spot where the "Giant" had met with his disaster. The editor of the 'Weser Zeitung' went himself to Nienburg and published an account of the voyage, in which there are many interesting details.

The 'Zeitung für Nord Deutschland' also enters into many curious and minute particulars, and says:—

"The unknown aerial travellers evidently wished to descend at Nienburg, and threw out an anchor, which caught the roof of the cottage of M. Kapp, hatter, but not finding hold, went away with a rafter. We do not know whether the rope of the grapnel, about an inch in diameter, broke or was cut off, as probably was the case; the grapnel, together with eighty feet of rope, remained in the house, and hundreds of people flowed in to see it. The same is about two-and-a-half feet high, of steel, with five flukes, and weighs sixty pounds. It can be screwed together in six or seven pieces. A second and similar grapnel is to be seen at Nölle's, the

gardener. The balloon, after having blown over the high road to Hanover, tripped against some telegraph wires, and nearly overturned. Four wires were broken in consequence of the shock, and three telegraph-posts torn down."

Other German papers say that—

"In the course of the balloon there were picked up several pieces of rope, some bits of iron, a speaking-trumpet, and a hat, with the maker's address in it, 'Boulevard de Sebastopol.' The latter piece of evidence suggests to the German intellect that possibly the people in the balloon might be Parisians."

At last we come to the narrative of one of the travellers, M. Eugène Arnould, reporter of the French newspaper, 'La Nation.' If this narrative is not, perhaps, strictly correct in all its details, as we may infer from a letter subsequently written by M. Nadar, it is, nevertheless, so graphic, that it ought to find place here:—

"My dear Editor, "Hanover, Tuesday, Oct. 20.

You saw us leave the Champ de Mars on Sunday. You were a witness of the majestic ascent of the 'Géant' rising into the air amid the applause of the crowd. They cried to us from below, 'Bon voyage!' Alas!

* * * * * * * *

"At nine o'clock at night we were at Erquelines; we passed over Malines, and towards midnight we were in Holland. We rose up very high, but it was necessary to come down to see where we were. Ignorant of that, our position was a critical one. Below, as far as we could see, were marshes, and in the distance we could hear the roar of the sea. We threw out ballast, and, mounting again, soon lost sight of the earth. What a night! Nobody slept, as you may suppose, for the idea of falling into the sea had nothing pleasant about it, and it was necessary to keep a look out in order to effect, if necessary, a descent. My compass showed that we were going towards the east—that is to say, towards Germany. In the morning, after a frugal breakfast made in the clouds, we redescended. An immense plain was beneath us; the villages appeared to us like children's toys—rivers seemed like little rivulets—it was magical. The sun shone splendidly over all. Towards eight o'clock we arrived near a great lake; there I found out our bearings, and announced that we were at the end of Holland, near the sea.

"We were compelled to think of landing, in order to take in a little ballast. Unhappily, the heavens had made us forget the earth, over which blew a wind so violent that in a few minutes our anchors, enormous fulcrums of iron, were broken. The valve was shut, and the balloon, which would carry us no longer, began a giddy career. We rose from twenty to thirty metres, and fell with incredible force. Little by little the balloon ceased to rise, and the car fell upon its side. Then began a furious, disordered race; all disappeared before us—trees, thickets, walls; all broken or burst through by the shock: it was frightful. Sometimes it was a lake, in which we plunged; then a bog, the thick mud of which entered our mouths and our eyes. It was maddening, 'Stop! stop!' we shouted, enraged with the monster who was dragging us along. A railway was before us—a train passing; it stopped at our cries, but we carried away the telegraphic posts and wire. An instant afterwards we perceived in the distance a red house—I see it now,—the wind bore us straight for this house. It was death for all, for we should be dashed to pieces. No one spoke. Strange to say, of those nine persons, one of whom was a lady, who were clinging to a slender screen of osier, for whom every second seemed counted, not one had any fear. All tongues were mute, all faces were calm. Nadar held his wife, covering her with his body. Poor woman! Every shock seemed to break her to pieces.

"Jules Godard then tried and accomplished an act of sublime heroism. He clambered up into the netting, the shocks of which were so terrible that three times he fell on my head. At length he reached the cord of the valve, opened it, and the gas having a way of escape the monster ceased to rise, but it still shot along in a horizontal line with prodigious rapidity. There were we squatting down upon the frail osier car. 'Take care!' we cried, when a tree was in the way. We turned from it, and the tree was broken; but the balloon was discharging its gas, and if the immense plain we were crossing had yet a few leagues, we were saved. But suddenly a forest appeared in the horizon; we must leap out at whatever risk, for the car would be dashed to pieces at the first collision with those trees. I got down into the car, and raising myself, I know not how, for I suffered from a wound in my knees, my trousers were torn. I jumped, and made, I know not how many revolutions, and fell upon my head. After a minute's dizziness I rose. The car was then far off. By the aid of a stick I dragged

myself to the forest, and having gone a few steps I heard some groans. St. Felix was stretched on the soil frightfully disfigured; his body was one wound; he had an arm broken, the chest torn, and an ankle dislocated. The car had disappeared. After crossing a river I heard a cry. Nadar was stretched on the ground with a dislocated thigh; his wife had fallen into the river. Another companion was shattered. We occupied ourselves with St. Felix, and Nadar and his wife. In trying to assist the latter I was nearly drowned, for I fell into the water and sank. They picked me up again, and I found the bath had done me good. By the assistance of the inhabitants the salvage was got together. Vehicles were brought; they placed us upon straw. My knees bled; my loins and head seemed to be like mincemeat; but I did not lose my presence of mind an instant, and for a second I felt humiliated at looking from the truss of straw at those clouds which in the night I had had under my feet. It was in this way we reached Rethem, in Hanover.

"In seventeen hours we had made nearly 250 leagues. Our *course infernale* had covered a space of three leagues. Now that it is over I have some shudderings. It does not signify; we have made a good journey, and I marvel to see with what indifference we may regard the most frightful death; for, besides the prospect of being dashed about on our way, we had that of gaining the sea; and how long should we have lived then? I am glad to have seen this—happier yet at having to narrate it to you. These Germans who surround us are brave people, and we have been as well cared for as the resources of the little spot will allow.

"P.S.—I have just reached Hanover with my companions, and reopen my letter to tell you so. The King has sent an aide-de-camp to us. Are we at the end of our reverses? At any rate, I am consoled to think they can no longer laugh at us in Paris. We have kept our promises, and more."

A fuller account of the adventures of the balloon in Belgium, Holland, and Germany, was given by the same writer in a second letter. It is so graphic that we cannot think of abridging it. Nevertheless, perhaps others of the travellers might tell the tale and the various incidents in a different manner:—

"We passed, I know not how much time, in contemplating the enchanting scene around us—but at length we all felt the necessity of going downwards to see where we were. Presently the balloon came so near to the earth that we could readily distinguish the tall chimneys of a great many flaming furnaces. 'If we were to fall upon some of them!' said Montgolfier, anxiously. These furnaces told us very clearly that we were in Belgium, and, besides, the Flemish songs that continually reached our ears left no doubt upon the point. Godard, Nadar, all of us, called out frequently to the people below, 'Where are we?' but we got no other answer than shouts of laughter. There were two bells in the car, and Yon and myself rang them as hard as we could, while Nadar roared through his speaking-trumpet. I had an opportunity of observing that the purity of the air in no degree attenuates the quantity of false notes lodged in the throats of certain individuals. Our aerial charivari at length provoked a corresponding one on earth, and we could hear dogs barking, ducks quacking, men swearing, and women screaming. All this had a droll effect; but time went on, the wind blew hard, it was dark night, and our balloon drove on with prodigious rapidity, and we were not able to tell exactly where we were. I could not see my compass, and we were not allowed to light a lucifer-match under any pretext whatsoever.

"From the direction in which we had passed over Lille, we judged that we must be going towards the sea; Louis Godard fancied that he could see lighthouses. We descended again to within 150 yards of the earth. Beneath us we saw a flat marshy country, of sinister aspect, and indicating plainly the neighbourhood of the coast. Every one listened with all his ears, and many fancied they heard the murmurs of the sea. The further we went on the more desert the country became; there was no light whatever; and it became more and more difficult to guess where we were going. 'I am entirely out of my reckoning,' exclaimed Louis Godard, 'and my opinion is that the only thing we have to do is to descend at once.' 'What, here in the marshes?' remonstrated all of us; 'and suppose we are driven into the sea.' The balloon went driving on still. 'We cannot descend here,' said Jules Godard, 'we are over water.' Two or three of us looked over the edge of the car, and affirmed that we were not over water, but trees. 'It is water,' Jules Godard persisted. Every one now looked out attentively, and as the balloon descended a little, we saw plainly that there was no water, but without being able to say positively whether there were trees or not. At the moment when Jules Godard thought he saw water, Nadar exclaimed, 'I see a railway.' It turned out that what Nadar took for a railway was a canal running towards the Scheldt, which we had passed over a few minutes before. Hurrah for balloons! They are the things to travel in—rivers, mountains, custom-houses—all are passed without let or hindrance. But every medal has its reverse; and, if we were delighted at having safely got over the Scheldt, we by no means relished the prospect of going on to the

Zuyder Zee. 'Shall we go down?' asked Louis Godard. There was a moment's pause. We consulted together; suddenly I uttered a cry of joy; the position of the needle of my compass indicated that the balloon had made a half-turn to the right, and was now going due east. The aspect of the stars confirmed this assertion. Forward! was now the cry. We threw out a little ballast, mounted higher, and started with new vigour, with our backs turned to the deprecated Zuyder Zee. It was now three in the morning, and none of us had slept. Just as we began to try to sleep a little, my diabolical compass showed that the balloon was turning back again. 'Where are you going to take us to?' cried out Yon to the immense mass of canvas which was oscillating above our heads. Louis Godard again proposed to descend; but we said 'No! forward, forward!'

Two hours sped away; and at five o'clock day broke, broad daylight coming on with marvellous rapidity. It is true that we were at a height of 980 metres. Novel-writers and others have so much abused descriptions of sunrise on mountains and on the ocean that I shall say little about this one, although it is not a common thing to see the horizon on fire below the clouds. The finest Venetian paintings could alone give an idea of the luxuriant tones of the heaven that we saw. Such dazzling magnificence led me to wonder that there is no revival of sun-worship, since men must necessarily have some material representation of the Divinity. It is true that the sun is not made in man's image. We now had beneath us an immense plain, the same probably that we had passed over in the night. There is nothing more pleasant at first sight, nor more monotonous, in the long run, than the sort of country which forms at least one-third of Holland. There are miniature woods the size of bouquets, fields admirably cultivated and divided into little patches like gardens, rivers with extraordinary windings, microscopic roads, coquettish-looking villages, so white and so clean, that I think the Dutch housewives must scour the very roofs of their houses every morning. In the midst of every village there is a jewel of a church with a shining steeple. While riding along at a height of 700 metres, we had beneath us a picture of Paul Potter's fifty leagues square. All at once the tableaux became animated. The people below had perceived the balloon. We heard cries expressive of astonishment, fright, and even of anger; but the feeling of fright seemed to predominate. We distinctly saw women in their chemises look hurriedly out of windows and then rush back again. We saw chubby boys looking at us, and blubbering as if they were mad. Some men, more determined than the rest, fired off guns at us. I saw several mammas pointing us out to stubborn babies, with an attitude which seemed to say that our balloon was Old Bogy. Old women raised their hands against us, and at their signal many ran away, making the sign of the Cross. It is evident that in some of these villages we were taken to be the devil in person. On this point it is apropos to cite a letter communicated to me which has been addressed to the 'Courrier de Hanovre.' I translate it literally:—

"'This morning, at about six o'clock, we saw passing over our heads, at a prodigious height, an immense round form, to which was suspended something which looked like a square house of a red colour. Some people pretend to have seen animated beings in this strange machine, and to have heard issuing from it superhuman cries. What think you, Mr. Editor? The whole country is in a state of alarm, and it will be long before our people recover their equanimity.'

"At 7 A.M. we crossed over a lake near Yssel; the wind then again drove us in a new direction, nearly at right angles with that which we were taking before. In less than a quarter of an hour the balloon got into Westphalia, near Renheim, then we crossed the great river Ems, the towns of Rheine and Ibbenburrhen, and returned to Hanover a little above Osnabruck; we traversed, without deigning to take notice of them, a little chain of mountains, and by way, no doubt, of relaxation after so long a journey, went all round a lake, which is called in German Dummersee. We then got into a great plain, through which runs a road. At this time the balloon became almost motionless. The reason of this was, that the heat of the sun had caused the gas to expand. The thermometer was then at 14½° (about 59° Fahr.). Louis Godard was very uneasy about this dilatation. After two or three oscillations, our aerial courser decided upon going off rapidly in an eastern direction, with about two degrees variation towards the north. This course would have taken us to Hamburg and the Baltic, but we were all so completely absorbed by the splendour of the tableau before us that we took little note of the change. Our hippogriff passed over Wagenfeld-Steyerberg, where there is a river which flows into the Weser. We came within sight of the great river and Nienburg, a considerable town on one of its banks. We saw a steamboat going down the river from the town. The view here was charming. A rustling of the silk of our balloon made us look upwards; the monster, under the influence of the sun, now very hot, was palpably swelling. As it would have been supremely ridiculous, after having made such a first-rate journey, to have treated the inhabitants of Nienburg

with the spectacle of seeing us blown up—to say nothing of the consequences of such a catastrophe to our own limbs—we resolved to come down. The remaining bags of ballast were got in order, the ropes and the anchors prepared, and Godard opened the safety-valve. 'The monster is disgorging!' exclaimed Thirion. And the balloon did vomit forth its gas with a tremendous noise, which may be compared to the snoring of some gigantic animal. While our companion made this observation, we were descending at the rate of two metres to the second. 'To the ropes! to the ropes!—hold on well!' cried the brothers Godard, who seemed quite in their element, 'take care of the shock!' Every one climbed up to the ropes which attach the car to the circular handles underneath the balloon. Madame Nadar, whose *sang froid* was truly magnificent, grasped two large ropes with her delicate hands. Nadar did the like, but at the same time put his arms round his wife so as to protect her body.

"I was on one side towards the middle of the sort of hurdle which serves as a balcony. I was on my knees and clinging to two ropes. Montgolfier, Thirion, and Saint Felix were near me. The balloon descended so rapidly that it gave us the vertigo. The air, which we had left so calm above, became a violent wind as we neared the earth. 'We are going to throw down the anchors,' said Godard, 'hold tight.' Then the car struck the earth with tremendous violence. I cannot imagine how it was that my arms were not broken. After the first terrible shock the balloon went up again, but the safety-valve was opened—it again fell—and we suffered a second shock, if not more violent, at least more painful to us than the first. Up we went again; the balloon dragged its anchors. Several times we thought we should be thrown out. "The anchors are broken,' exclaimed Godard. The balloon beat the ground with its head, like a kite when it falls down. It was horrible. On we went towards Nienburg, at the rate of ten leagues an hour.* Three large trees were cut through by the car, as clean as if by a woodman's hatchet. One small anchor still remained to us. We threw it down, and it carried away the roof of a house.

"If the balloon had dragged us through the town we should, inevitably, have been cut to pieces. But fortunately it rose a little, and then bumped against the ground again with as much violence as before. Every one of these shocks wrenched our limbs; to complete our misfortunes the rope of the safety-valve got loose from us, and the safety-valve shutting up we lost all hope of the balloon emptying itself. It went on by bounds of twenty-five, thirty, and forty metres from the earth, and continued to fall upon its head. Everything that stood in the way of the car was dashed to pieces. Every minute brought a new danger, and what danger! Now we are terrified to think of it; but I declare upon my honour that at the time not one of us entertained a thought of saving his own life at the expense of the community. Several times some one of us might have jumped out, but then the balloon, being lightened of a considerable weight, would have ascended to the great peril of the others. Madame Nadar was supported by her husband, and I can affirm that our greatest moral suffering was to see her frail form so terribly knocked about—and yet this poor woman never uttered a cry. During these terrible moments when all our bones were cracking, she looked at her husband and at us so calmly and so sweetly that we would all willingly have been crushed to have saved her."

We complete the narrative of the second ascent by giving here Louis Godard's own account:—

The departure presented nothing remarkable until Erquelines was reached. If the balloon did not attain any great elevation, it was because the aeronauts wished to avoid all dilatation, in order to make a long voyage; if they had wished to have produced an effect upon the public, they could have attained the highest elevation by throwing overboard 60 lbs. or 80 lbs. of ballast.

The balloon used on fête days, belonging to MM. Godard Brothers, decked with flags bearing the initials of His Majesty the Emperor, and the "Giant," met four or five times in the air, and the aeronauts of the latter, thinking they were addressing the inhabitants of a town, received the replies of M. Godard, senior, who directed the small balloon. This pursuit did not cease until St. Quentin was reached, where the latter descended.

The "Giant" continued its route. Signalised at Lille, it proceeded in the direction of Belgium, where a fresh current, coming from the Channel, drove it over the marshes of Holland. It was there that M. Louis Godard proposed to descend to await the break of day, in order to recognise the situation and again to depart; it was one in the morning, the night was dark, but the weather calm.

Unfortunately, this advice, supported by long experience, was not listened to. The "Giant" went on his way, and M. Louis Godard no longer considered himself responsible for the consequences of the voyage.

* The letter of M. Louis Godard, given below, says, in two places, that the balloon, when descending, was driven by the wind at the rate of sixty leagues an hour; but this is probably a misprint.

The balloon coasted the Zuyder Zee, and entered Hanover. The sun began to appear, drying the netting and the sides of the balloon, wet from its passage through the clouds, and produced a dilatation which elevated the aeronauts to 15,000 feet.

At eight o'clock, the wind, blowing suddenly from the west, drove the balloon in a right line towards the North Sea. It was necessary, at all hazards, to effect a descent. This was a perilous affair, as the wind was blowing with extreme violence.

The brothers Godard (Louis and Jules), assisted by M. Gabriel, opened the valve and got out the anchors; but, unfortunately, the horizontal progress of the balloon augmented from second to second. The first obstacle which the anchors encountered was a tree: it was instantly uprooted, and dragged along to a second obstacle, a house, whose roof was carried off. At this moment the two cables of the anchors were broken without the voyagers being aware of it, such was the prodigious speed attained, sixty (?) leagues an hour.

Foreseeing the successive shocks that were about to ensue—the moment was critical, the least forgetfulness might cause death. M. Louis Godard did not cease to give to all repeated encouragement; the balloon still went on at the rate of sixty leagues an hour; through opening the valve it had lost a certain quantity of gas, and could not ascend. To add to the difficulty, its inclined position did not permit of operating on the valve, except on the hoop.

At the request of his brother, Jules Godard attempted the difficult work of climbing to this hoop, and, in spite of his known agility, he was obliged several times to renew the effort. Alone, and not being able to detach the cord, M. Louis Godard begged M. Yon to join his brother on the hoop. The two made themselves masters of the rope, which they passed to M. Louis Godard; the latter secured it firmly, in spite of the shocks he received.

A violent shock shook the car and entangled M. de Saint-Felix under it, as it was ploughing the ground; it was impossible to render him any assistance, notwithstanding M. Jules Godard, stimulated by his brother, leaped out to attempt mooring the balloon to the trees by means of the ropes. M. Montgolfier, entangled in the same manner, was reseated in time and saved by Louis Godard.

At this moment MM. Thirion and D'Arnoult leaped out in their turn, and escaped with a few contusions. The car, dragged along by the balloon, broke trees more than half-a-yard in diameter, and overthrew everything that opposed it.

M. Louis Godard made M. Yon leap out of the car to assist Madame Nadar, but a terrible shock threw out

GODARD'S "L'AIGLE" (1864).

MM. Nadar, Louis Godard, and Montgolfier—the two first against the ground, the third into the water. Madame Nadar, in spite of the efforts of the voyagers, remained the last, and found herself squeezed between the ground and the car, which had fallen upon her. More than twenty minutes elapsed before it was possible to disentangle her, in spite of the most vigorous efforts on the part of every one; it was at this moment the balloon burst, and, like a furious monster, destroyed everything around it.

Immediately afterwards they ran to the assistance of M. de Saint-Felix, who had been left behind, and whose face was one wound, and covered with blood and mire; he had an arm broken, his chest grazed and bruised.

I terminate this true relation, in thanking the inhabitants of Rethem, particularly our ambassador and the king's envoyé, for the care and attention they showed us.

(Signed) Louis Godard.

M. Nadar, dating from Hanover on the 26th, wrote—

"All goes on better. We are about to return to Paris on our backs; but in a far better state than eight days ago.

"As it is impossible at this moment to write to all the journals which have been pleased to mention our second voyage, with a sympathy which profoundly affected me, I shall be grateful to them to reproduce the present explanation.

"Nadar."

I cannot omit to insert in this history a few extracts from the 'Oraison Funèbre' on Depuis Delcourt, given by M. Nadar in the preface to his 'Mémoires du Géant.' Though we are not accustomed to such discourses in our own country, yet in this instance it is my desire "to show how much the zeal of one man in a good cause can effect":—

To-day, Sunday, 3 April, 1864, thirty persons were assembled at a small house in the Rue de Soureine, Paris. From thence we proceeded in the rain to inter the patriarch of French aeronauts, Jean-Baptiste Depuis-Delcourt, born 25 March, 1802. Depuis Delcourt was known both in the literary and the scientific worlds; but the success he obtained as a dramatic author could never turn him from aerostation, his ruling passion. He had known J. Montgolfier and Charles, and was present at the experiments of Deghen, Lennox, Garnerin, Robertson, Le Berrier, and had witnessed the death of the unfortunate Madame Blanchard. He had himself made many ascents, and been presented to Louis XVIII., from whom he received the gift of a beautiful diamond.

The Academy on five occasions named commissions to examine the scientific communications he sent in to them with indefatigable zeal.

He laboured with Arago in the construction of the "electro-subtracteur," an instrument that could at will deliver us from hail, not only in its falling but even its formation.

In the Orangery of the Luxembourg he had made public experiments with the aerial screw; and among the most attentive of his auditors was Geoffrey Saint-Hilaire.

He founded the "Aerostatic and Meteorological Society of France," of which he was the soul; and in recognition of his services they named him their Perpetual Secretary.

Even after the anathema of Marey Monge against metallic gasholders he completely ruined himself by the construction of a copper balloon; but for the want of a few hundred francs to supply accessories it could not be used, and he was obliged to sell it. He published twenty books and pamphlets; among others the 'Manuel de l'Aérostier,' one of the best volumes of the useful Encyclopædia of Roret.

He leaves almost finished an important work, entitled, '*Traité complet, historique et pratique des Aérostats.*' Of this he said, "*Ce sera probablement la grande affaire de ma vie!*"

He founded a Journal of Aerial Navigation; and, full of fervent faith in the future of this science, he collected, with his scanty purse, under many privations, the best Aerostatic Museum that exists.

Now, this man, gentle and brave, modest, laborious, and disinterested, after having devoted himself to an idea that may have the grandest practical effect on the human race, lived with resignation and confidence in extreme poverty, and died yesterday, leaving his collection as his sole legacy to the aged companion of the last thirty years of his life.

This worthy woman, who, with the faith a wife has always in a husband, had followed him everywhere,

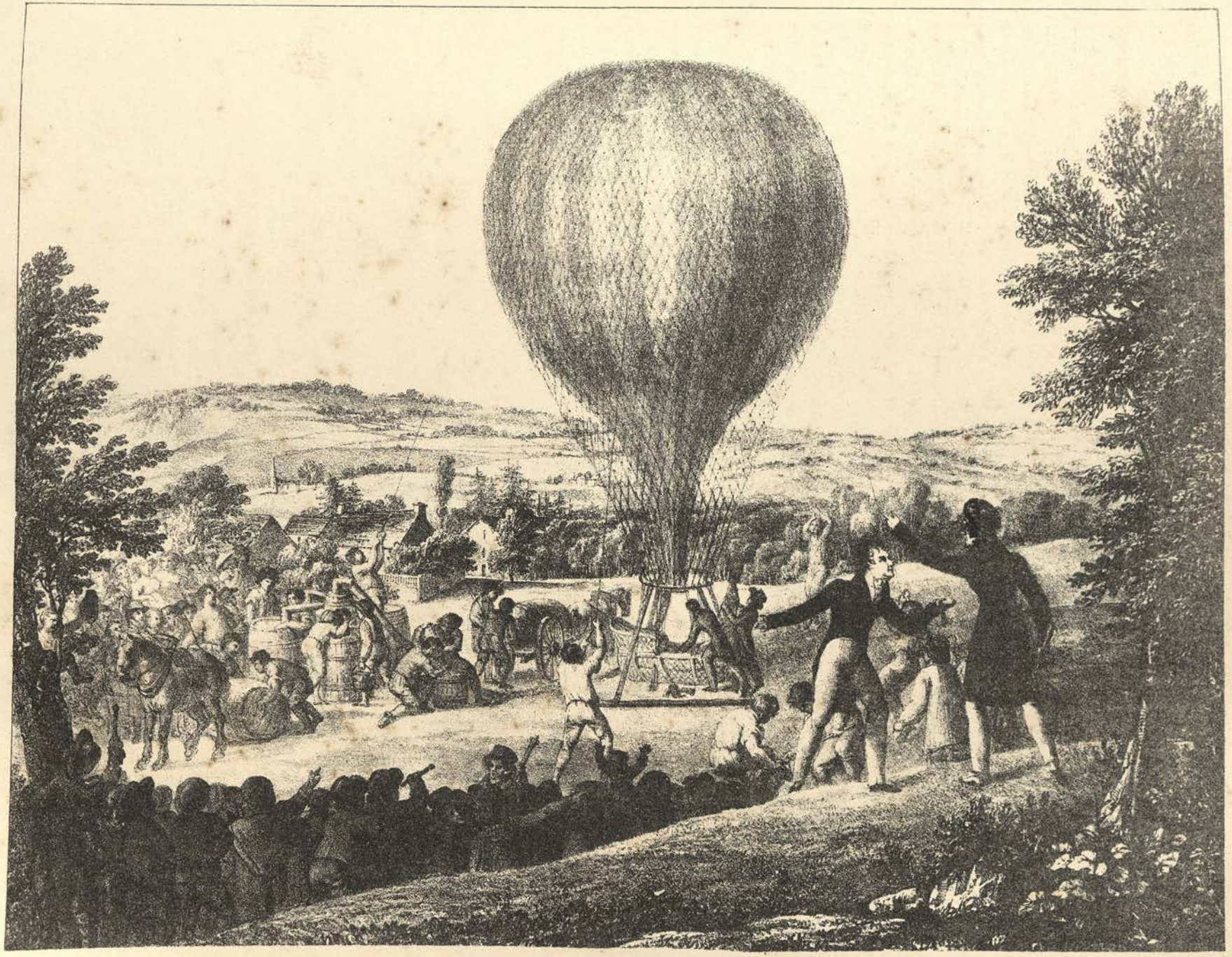

Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col.Sir H.James R.E. F.R.S.&c.Director.

according to the Gospel, and even beyond the code, as far as the clouds, now preserves with a pious respect the COLLECTION that will hereafter be well known as that of DEPUIS DELCOURT.

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To complete this chapter I here annex some extracts from a curious work entitled 'La Navigation Aérienne' (of which, however, I do not guarantee the authenticity).

'La Navigation Aérienne en Chine, relation d'un Voyage accompli en 1860, entre Fout-cheou et Nant-chang,' by Delaville Dedreux. This work, which appeared in Paris in 1863, contains many ideas that are novel. The author reminds the reader of a book called the 'Merveilles du Génie de l'Homme,' by Amédée de Bast, wherein it is stated that Father Vassou, a missionary at Canton, in a letter dated September 5, 1694, mentions a balloon that ascended on the coronation of the Emperor Fo-kien, in 1306. He found this recorded in authentic official documents. M. Dedreux then states that, having gone far into the interior of the Celestial Empire, he thinks it his duty to publish what he there saw; but not being a scientific man, he can give only an account of the facts.

N aerial equipage one morning coming suddenly in sight gave rise to the following conversation between the Mandarin Kie Fo, his protector, and himself.

The Asiatic sarcastically remarked to his queries, "Are you not so far advanced as to have these things in Europe?"

"Oh, yes," answered the European, "but they are of smaller dimensions, our engineers devote their attention chiefly to the study of the methods for destruction, and you have seen what they can do."

"As it is evident," replied Kie Fo, "that you do not know much about these aerial ships, I shall be glad to make a trip with you."

"I shall be delighted, and am ready to run all risks."

"No courage is required," continued the Chinaman, "as aerial locomotion is the most agreeable and least dangerous that exists."

"Can the Chinese guide balloons at will?"

"Not altogether, but it is seldom that the captain does not follow his proposed route, and return within a given period. This is effected chiefly by a knowledge of the atmospheric currents, and of the meteorological circumstances that change their direction. The knowledge of the winds is a science that is enriched by daily observations. The Celestial Empire possesses a great number of observatories, which send their reports of the currents at the various heights to the captains of aerostats, who are guided accordingly."

"But how do you know the direction of the currents?"

"By sounding, as we have an instrument called the atmospheric sounding-line which is only a small balloon connected by a string to a tower thirty feet in height, which contains a large wheel that marks the number of feet unrolled. The top forming a horizontal circle is divided into 400 degrees, the first corresponds to the north, &c., the direction of the current carries the string in a direction marked by one of these lines, and no mistake is possible."

"I understand that perfectly, but how do you transmit the intelligence to the place from whence the aerostat starts?"

" It is in this that the inventive genius of the Chinese is shown, for many are employed with a variety of trumpets that give different sounds for each line, which are repeated at smaller stations till it arrives at the place of departure." I spoke to him of the telegraph, but it was useless.

This conversation recalled to my mind what I had seen in the London Exhibition of 1851 (called Universal, at which, however, China showed nothing). A map of England was shown on which needles were placed on all the principal ports, and were arranged each day according to telegrams; one was thereby able to see at a glance the direction of the winds all along the coast. I have thought that such a map adapted for Europe would speedily give us such knowledge of atmospheric currents that we should at once be able to turn balloons to account. I observed that " many sides of an irregular polygon must be described in an aerial voyage ? "

" That is the case," replied the Mandarin, " it seldom happens that one can travel in a straight line. The talent of the captain consists in finding out the quickest route; often when the north is the goal you may see him making for the east or west according to his directions. He carries sounding-lines that acquaint him with the currents above and below, and of these he can take advantage."

" I can understand the method for raising and lowering the machine, as one of our engineers explained it in theory seventy-five years ago; but no use has yet been made of it. What still puzzles me is this: On the sea a captain by the assistance of the log and compass knows the rapidity and direction of his route, but the captain of an aerostat cannot make use of these."

" I beg your pardon, the compass is used; as long as the earth is in sight it is not much required, but above the clouds, or at night, or in an unknown country, it is of the greatest use."

I had formed my opinion from the works of Louis Figuier, called ' Exposition et Histoire des principales Découvertes scientifiques Modernes,' who in his remarks on balloons says, " the form of the ship enables the captain to judge of the direction when looking at the compass, but in the air there is no line to guide the eye of the aeronaut."

" To you, your author may seem right," said Kie Fo, " but he is wrong in our view. I will explain the Chinese method. Our oblong aerostat that keeps its stern to the current has an imaginary line passing from stern to prow. Now you know that a boat in a current without oars or sails will turn any way, but the least resistance caused at the stern will make it keep lengthwise with the stream. It is by resistance at the stern that we keep the aerostat even with the current."

" How can you produce this resistance ? "

" Simply by the rotation of a screw at the stern. A man turning a handwheel would suffice."

" Well, I understand; but how can you make up for the log, for determining your swiftness ? "

" By a hammer."

" What do you mean by a hammer ? "

" By a hammer and a lamp—this will explain it. You did not see, this morning, a single one but two aerostats rise; this is always the case. A complete equipage always consists of two. They are connected by a silken cable. The one nearest the wind turns the screw that impedes its march, while the one in front, not doing this advances more rapidly. The cable then takes a curve which the experienced eye of the captain soon recognises to be correct. The two balloons are 360 metres from one another; this is the distance as you know that sound travels in one minute. At the bow of the second aerostat there is a man with a hammer called the 'striker;' at the stern of the first there is a marker, having before him a large disc with divisions, like a clock face, with only one indicator, and divided in 360 degrees. This needle is put in motion by pressing a button, and stops directly the pressure is taken off. It can make the turn in one second. From time to time the marker makes a signal to the striker, who lets his hammer fall on a metal plate, and instantaneously a burning lamp is unmasked. The marker, the instant he sees this, presses the spring till the sound reaches the ear; he removes the pressure and the indicator stops. In a perfect calm this would be always one second, or one turn of the indicator, but if the aerostats are in movement, it varies according to the rapidity of motion. For instance, supposing this to be thirty-six kilomètres (twenty-seven miles) an hour, this would be ten mètres (thirty-two feet six inches) a second; and the indicator would make a complete circle, and not stop till ten lines beyond."

" I understand; but it must require a quick man as marker."

" They are in great demand, and their pay is high. The lamp is required by night, and also on account of the rapidity with which light travels. Hold yourself in readiness to start to-morrow morning."

I was astounded with the conversation, and at learning in a few minutes so much about principles that are reputed insoluble in Europe, or at least very doubtful of realisation, while in the Celestial Empire they are solved and applied on a large scale. Yet it did not appear to me that the art even here had reached its utmost perfection, but that the appliances of Europe could afford many improvements.

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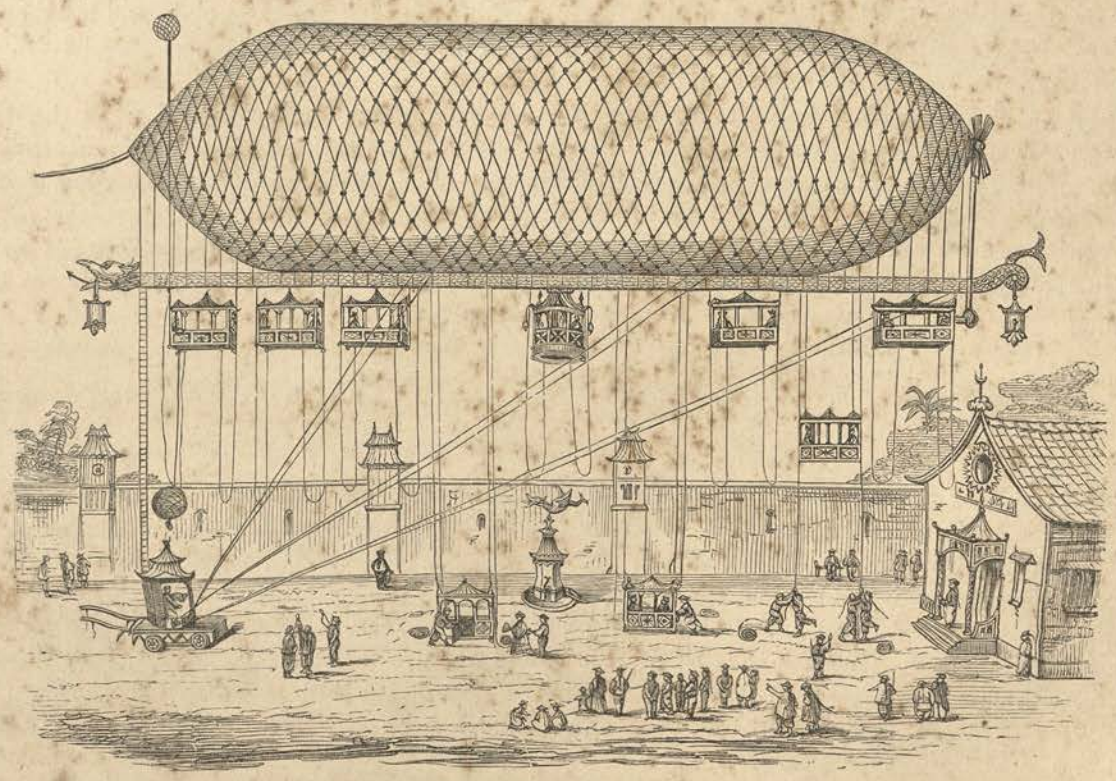
The Mandarin informs Mons. Dedreux that their sovereign being the son of Heaven, is infallible, and that of necessity his ministers partake of his infallibility.

"If, therefore, electricity (mentioned in the conversation of yesterday) could have been of use, it would have been adopted. It is not likely that you who are ignorant of the first principles of this science could suggest an improvement."

"Take," he continued, "this silk dress, well suited for changes of temperature, and let us start."

The freshness of the morning was enjoyable whilst we walked down a glade through a wood that extended along the valley and up the sides of the hills on either side. It gradually narrowed till we saw it end in an amphitheatre less than a mile in circuit, with almost perpendicular sides, evidently altered by the hand of man. Here we found ten aerostats of snowy whiteness, all turned in one direction. Eight glades converged, starlike through the wood, and met at an opening whereon were as many platforms, so arranged as to slide down these glades by their own weight. A circular staircase gave access to what may be called the ramparts of the amphitheatre.

"This," said Kie Fo, after enjoying my surprise, "is the starting-place. Many towns have similar stations arranged by rules that the experience of centuries has rendered permanent. Their form you will observe protects them from all winds. Those well worn slopes are for the descent of the towing-machines; that open space is the landing place; for descending pipes convey water in all directions, as it is required in dry weather." We ascended the staircase and looked down the valley. As two aerostats are always joined together we arrived opposite one, and saw several pedestrians arriving by the various glades (the Chinese word for the aerial starting-



THE CHINESE AEROSTAT.

place corresponds with our word terminus). We noticed that it was not adapted for holding more than five equipages (that is ten aerostats, as two are always connected). We arrived opposite one and found a waiting-room that opened on a level square. (See vignette.)

About the centre of the court I saw a chariot, low and massive, on four wheels, bearing a basket somewhat similar to the car of an European balloon. From this basket there ascended four ropes attached to a horizontal mast ornamented at prow and stern by the head and tail of a dragon. This appeared immovable about thirty feet overhead. On examining the balloon above I found that it was not egg-shaped as I had thought at first sight, but has a cylinder terminated at each end by a cone—it was attached to and almost touching the mast. In addition to the ropes that bound the mast to the chariot were twenty others, attaching the ten cars, and one reached to the ground from each car. At the centre of the mast was attached a car larger than the rest, somewhat like a large sentry-box, which was quite the centre of everything, as a funnel of glazed silk connected it with the aerostat.

"That man in the chariot," said Kie Fo, "is the watcher."

"What is he watching?"

"To see that the aerostat always keeps lengthwise to the wind. He effects this with the four cords—it is thus that in an open country, with a strong wind, we can land with little risk. Remark, he added, that the first rope descending from the prow is almost vertical, it is the axis of rotation (or the stem of the weathercock), whilst the fourth rope represents the hypotenuse of a right-angled triangle, of which the mast forming one of the sides is always horizontal. The intermediate ropes are more especially intended to prevent the mast from bending, from the ascensive force of the aerostat."

The captain whistled, and the cars were lowered, each containing two seats. Two men who managed the machine first took their seats in the central car. Two ladies were then admitted. We got into the second car from the prow, the first being occupied by the captain and lieutenant, whilst the car nearest the stern conveyed the marker and his assistant. We were weighed, as each car must carry 160 kilogrammes (400 lbs.), the difference is made up by water being carried in the double bottom of the car. The total weight carried by the aerostat was 1600 kilogrammes, excluding the cars and tackle. This has to be equally distributed. We were then hoisted and made fast. After waiting a few minutes to see whether any one was coming to occupy the vacant car, it was filled with water and hoisted also.

"Our aerostat," said Kie Fo, "is the one that leads, and carries, therefore, the captain and marker; whilst the other carries the striker and the 'sondeur' (or the carrier of the sounding-lines)."

"Will not our watcher also be hoisted?"

"No, he always remains thirty feet below us; his duty is to throw the anchor, and when the equipage reaches the ground he becomes the towing-machine; he it is also who, at the signal of the captain, starts us."

I heard near my ear the movement of a rope, and saw one sliding along the mast. "They are making the tackle fast," said Kie Fo.

A prolonged whistle from the rear balloon was answered by our captain to the watcher to "Let go." We ascended rapidly several hundred feet, then moved in a horizontal direction. I shall not endeavour to describe my feeling.

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"Well," said Kie Fo, "do you think it requires much courage to travel in our aerostats? Do you not feel in perfect security?"

"Yes, and the air is most refreshing."

"All feel this; and for this reason it is that those ladies are enjoying this excursion, being a more pleasant airing than can be found on land or water. We have here neither jolting, nor dust, nor sea-sickness, no danger of founding, nor of being upset or impeded."

"The only danger is that of being precipitated to the ground."

"No, that danger does not exist; what could cause our fall? There is no friction, it goes with the wind. Being always full there is no risk of tearing. It is painted white so that the sun's rays should not affect it. As it never approaches nearer than thirty feet to the earth there is but little chance of damage; it is besides carefully inspected at starting. You shall, however, see them in process of building, and I trust that you will then be reassured."

"I am already. Who is that traveller?"

"A consumptive man who makes two journeys a week; when he has strength to make three he will probably be cured."

"Aerial voyages have then medicinal virtues?"

"Certainly, all our doctors agree on this, and their opinion is based on excellent statistics. The only drawback is that it is an expensive cure, which only the rich can afford."

"Who is that little dried-up man? He has not the air of being here for his own amusement."

"He is a commercial traveller of a large house that does business in jewellery, gold and silver filigree, painting on rice-paper, and other merchandise of great value and little weight. Small thin men are usually chosen for this situation, so that weight may be economised. I am sure that he does not weigh fifty kilogrammes. As there will not I am sure be a drop of water at the bottom of his stall, the difference is made up by his wares."

"Who are the two in uniform?"

"They are two officers in the Aerial Service of the State, going most likely to join their aerostat at Nant-Chang. The distance from where we started being 300 miles, we shall arrive about noon if the wind is favourable."

"Has the State then an aerial flotilla?"

"Certainly. Scientific research is the chief object of the State aerostats; the officers being trained in schools for the purpose; and it is a service much in vogue: geography, geology, astronomy, meteorology, natural history, and other sciences have been enriched by it. There is not one of our mountains that has not been explored by Chinese *savans* by means of these aerostats. There are many narratives of voyages far to the south, but their progress has been stopped by the excessive heat. An excursion has even been projected to the Pole. I have here a copy of the 'Pekin Gazette' that contains an interesting article on this subject, shall I read an extract?"

"I shall be much obliged."

"'Among the travellers who have endeavoured to reach the Pole, but have been stopped by the ice, have been some who have proposed sledges carrying boats to cross the unfrozen seas. If men are found hardy enough to attempt such a project, would it not clearly be easier to accomplish this by the aerostat—in order to reach the point of the globe that must awaken the utmost curiosity from the novel appearance of the heavenly bodies and the altered relations of magnetism? The distance is not 1200 miles to the Pole and back in starting from the point where the ice stops us; favourable winds could conduct us there and back in two days; and if there are in this region horizontal currents (superimposed) flowing to and from the Pole, where is the impossibility of the attempt that at first sight appears chimerical?'

"Thus you see," said Kie Fo, folding up the paper, "that the idea of visiting the Pole by an aerostat *travaille les esprits*, and I shall not be surprised if it is soon tried."

"Whatever may be the result, the nation that first tries it would deserve honour; but as your aerostat makes such long voyages, how does it happen that none of them come to Europe?"

"Your little country is hardly worth the trouble. Barbarians (without any intention of offending you) are not esteemed by our government, who are certain the Chinese would only import pernicious ideas from Europe. Aeronauts are therefore forbidden, under penalty of death, to visit that small agglomeration of evil-disposed and fighting men, that Providence has collected into a corner of the earth, of which the Celestial Empire occupies the centre."

"The Europeans, believe me, are neither so vicious nor fond of fighting as your government would make you believe. If they would allow you to visit us and study our manners, you would certainly change your opinion."

"To speak frankly, I agree with you, but I dare not proclaim it for fear of punishment; a day will doubtless come when the present ideas will be changed."

"I trust it may arrive quickly, for the benefit of mankind."

Whilst talking in this way, we were moving rapidly, as from the lowness of our altitude the country appeared to fly along beneath us: a whistle interrupted our conversation.

"The captain," said Kie Fo, "is ordering *le tourneur d'hélice*, posted in rear of the aerostat that follows us, to begin working. Since our start the two aerostats have been at an intermediate distance. Not having lost sight of the ground, the captain, who well knows this country, has not required the instruments for steering; but it appears to me that we are going to higher regions to find another current. He will then require both the compass and the 'speed-marking disc.' You can just see from here the action of the screw that retards the movement

of the second aerostat. The cable is stretched as it should be; the two aerostats are now 360 metres from one another."

All at once a prolonged hissing caused me an instant's alarm.

"Do not be frightened," said my friend, "some of the atmospheric air that was *emmagasiné* in the aerostat has been allowed to escape. We are about to ascend some 3000 feet."

In a few minutes we were in the clouds. The striker was at his post in the second aerostat, as from time to time I saw the flame of the lamp, and an instant after heard the blow of the hammer.

The marker at the stern of our aerostat called out the speed indicated by his disc, and the lieutenant beside the captain at the prow took note of the measurement.

The telegraph would be better, I thought; but, aloud to Kie Fo: "We ascend therefore, on account of the escape of a certain quantity of atmospheric air enclosed in the aerostat; and when descent is necessary the air is again pumped in, I suppose, at the central cabin."

"That is it: but who has instructed you in this?"

"I have already told you that what I have just noticed was imagined and proposed in France eighty years ago. It was even tried; but, not succeeding, the experimenters were satirised, and they took care not to risk their lives again; as my good countrymen often forget that unhappy mortals only arrive at success through failures. These two lines of our immortal fablist apply admirably to the first realiser of a new idea:—

'Il s'y prit d'abord mal, puis un peu mieux, puis bien,
Puis enfin il n'y manqua rien.'"

Now our aeronauts, among whom was a royal prince, the Duke de Chartres, were unsuccessful, and were ridiculed instead of encouraged. The idea they endeavoured to apply had been the subject of a clever memoir presented by its author to the French Academy, and was very favourably received by that illustrious assembly.

The check these courageous men met with at starting caused the project to be laid aside for half a century, till in 1840 the distinguished author of 'Histoire des principales Découvertes scientifiques Modernes' again brought it to light.

I will here suspend my narrative and give the 'Mémoir du Général Meusnier, Membre de l'Académie des Sciences.'

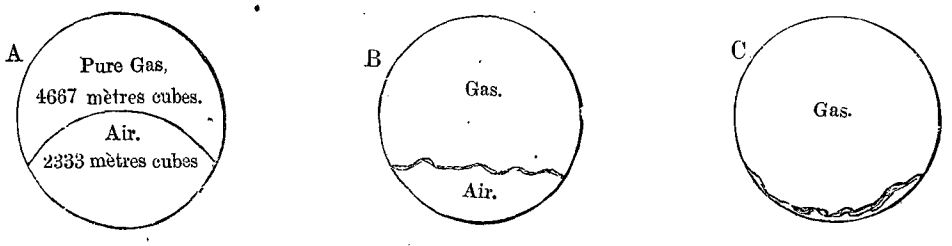
This is worthy the attention of all who have time to devote to this science; but, as it will not interest the general reader, it need not be inserted here. M. Dedreux continues:—

* * * * * * * * *

I will point out the relation of the Chinese aerostat to the foregoing calculations by the description of the aerostat in which I made the ascent.

This aerostat, as I have already said, was a cylinder terminating at both ends in cones, it was 16 metres in diameter, 40 metres in length, and its volume about 7000 cubic metres.

In the interior running the whole length of the aerostat there is a light impermeable canvas that divides it in two compartments; the upper for containing pure gas, and the lower for the atmospheric air that constitutes the ballast. At starting the lower compartment is full of air, and the canvas division takes the form shown at A, representing a transverse section of the aerostat.




At low altitudes the canvas separation floats between the gas and the air, as at B.

At the highest altitude the balloon can reach, all the air is forced out by the expansion of the gas, and the canvas division rests on the exterior covering of the aerostat, as at C.

I omit the calculations which M. Delaville Dedreux gives to show the powers of this machine, merely adding the conclusion:—

* * * * * * * * *

Let us now remark to what height this aerostat can rise. It has reached its greatest altitude when there is no air in the lower compartment. The gas contained at starting within a space of 4667 metres, fills at this height a volume of 7000 metres. Its density is therefore dimished one-third, and this is always equal to that of the "atmospheric layer" in which the aerostat is suspended. The barometer at this height is at 51 centimetres (two-thirds of 76). Now, one knows by calculation confirmed by experiment, that this height of the column of the barometer corresponds to an altitude of 3000 metres, and "to this height our aerostat can go," said Kie Fo.

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We did not reach this height; but we remained long in a thick mist, and I was not sorry at length to hear the captain order the two men in the central cabin to work the ventilator, so as to cause descent. This "ventilator" looked like a horizontal funnel, two metres in diameter, that takes in the air from below, and throws it into the aerostat by a vertical pipe of impermeable canvas, by this means no force is wasted. Besides, by the position of the funnel it causes the vessel to descend by sucking in the circumambient air. Nevertheless the descent is slow, as I remarked to Kie Fo, who answered, "Our ventilator is only worked by two men; four is the complement; in State aerostats eight men work it. It is no light affair to pump in the 2333 cubic metres required to make an aerostat descend from a height of 300 metres."

"Steam-power would assist you."

"What! put fire under an aerostat! Are you a fool? That is not possible!"

"It is, as I saw it in Paris, where an engineer rose with a steam-engine of 3-horse power, hoping to find a method of direction; but not succeeding, he did not try a second time."

Whilst lost in reflection, Kie Fo showed me in the distance a black spot which was the terminus of Nant-chang. In another half-hour we were over the plain for the towing-machines. As the aerostat kept on descending as we approached I saw that we should soon land.

On the plain were two chariots with four horses similar to those I had noticed at starting. They appeared to be waiting for us, and near each of them was a man on horseback. The nearest chariot followed us whilst the other kept as close as possible to the second aerostat, no longer connected to us by the cable. When within 30 metres the watcher allowed a rope to fall to the ground; the man galloping after us, seized and threw it adroitly on the chariot, where it was attached to a windlass that two men began at once to turn till they had drawn the car of the "watcher" to the chariot. We were at our moorings. When we were securely attached the horses drew us at a gallop towards the terminus, and left us at the slope, down which the chariot ran of its own weight. At the bottom another relay of horses awaited us, and we were conveyed to the platform for descent, where porters attached the chariot and successively let down the stalls. The second aerostat had reached at the same time a neighbouring platform, so that the forty passengers were again united before dispersing.

"Do you observe," said Kie Fo, "the necessity for placing the terminus in the centre of a vast plain, with a hard and level soil that will allow horses and chariots to move in all directions?"

"Yes, I noticed the wind did not take us direct to the terminus, and that if we had not been towed we should have passed to one side of it. You rectify, by towing, the inexactitude of the winds. It is well contrived, I understand now the use of the chariot and four horses."

"Notice also that they are heavy and low to prevent being upset. When the wind is contrary or too violent they remain stationary, lock the wheels, and wait till the weather is more favourable."

We passed the rest of the day and part of the next at Nant-chang, and went to the building-yards where the aerostats are constructed; but their description would fill a volume. I admired with what economy and rapidity these enormous machines can be constructed, when all is provided by suitable contrivances indicated by long experience.

I remarked that in China a new aerostat rises from its building-yard, instead of what has hitherto been the custom in Europe of dragging a machine inflated, or half inflated, to the place of ascent, much to its injury; as was the case in 1834, when the famous aerial ship, "L'Aigle," of M. De Lennox, with the greatest difficulty was brought to the Champ de Mars; where it arrived almost in tatters—to the discontent of the multitude, who tore it to pieces.

To come from Fout-chou to Nant-chang, we had left in the morning, in order to profit by the sea-breeze that reaches far into the interior; to return, therefore, we were to leave in the evening to take advantage of the land-breeze.

Whilst waiting for a repast, Kie Fo took me into an office of the Terminus, where on a table I saw a map, similar to the one I had seen in London in 1851, with the observatories marked by black circles, on which were four needles superimposed on each observatory: these showed the directions of the wind throughout a vast tract of country at the respective heights of 2000 metres, 1500 m., 1000 m., and 500 m.

The clerk without hesitation named the hour of our departure.

I shall not give the description of the return voyage, but M. Delaville Dedreux ends his book with this wish, that our engineers will be able "En combinant les procédés Chinois avec les découvertes modernes de notre hémisphère, ils doteront sans doute l'humanité d'un nouveau et puissant moyen d'investigation de diffusion des lumières et de civilisation.

"Ils feront de notre siècle le véritable Grand Siècle."

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### The Utility of Art.

Two men I honour, and no third. First, the toilworn craftsman, that with earth-made implements laboriously *conquers the earth, and makes her man's.* Venerable to me is the hard hand—crooked, coarse—wherein, notwithstanding, lies a cunning virtue, indefeasibly royal, as of the the sceptre of this planet. Venerable, too, is the rugged face, all weathertanned, besoiled with its rude intelligence; for it is the face of a man living manlike. Oh, but the more venerable for thy rudeness, and even because we must pity as well as love thee! Hardly-entreated brother! For us was thy back so bent; for us were thy straight limbs and fingers so deformed: thou wert our conscript on whom the lot fell, and fighting our battles wert so marred. For in thee, too, lay a God-created form, but it was not to be unfolded; encrusted it must stand with the thick adhesions and defacements of labour, and thy body was not to know freedom. Yet toil on, toil on; *thou* art in thy duty, be out of it who may; thou toilest for the altogether indispensable—for daily bread.

A second man I honour, and still more highly: him who is seen toiling for the spiritually indispensable, not daily bread, but the bread of life. Is not he, too, in his duty, endeavouring towards inward harmony, revealing this by act or by word through all his outward endeavours, be they high or low?—highest of all, when his outward and his inward endeavour are one—when we can name him artist; not earthly craftsman only, but inspired thinker, who with *heaven-made implements conquers heaven before us!* If the poor and humble toil that we have food, must not the high and glorious toil for him in return, that we have light, have guidance, freedom, immortality? These two, in all their degrees, I honour; all else is chaff and dust, which let the wind blow whither it listeth. Unspeakably touching is it, however, when I find both dignities united; and he that must toil outwardly for the lowest of man's wants, is also toiling inwardly for the highest. Sublimer in this world know I nothing than a peasant saint, could such now anywhere be met with. Such a one will take thee back to Nazareth itself: thou wilt see the splendour of heaven spring forth from the humblest depths of earth, like a light shining in great darkness.—Carlyle.

All things are full of labour; man cannot utter it.—Eccles. i. 8.

# CHAPTER VIII.

## WAR-BALLOONS.

"Whatever is complicated, fails in producing good results in warfare; the promoters of systems forget always that the object of progress ought to be to obtain the greatest possible effect with the least possible effort and expense."—NAPOLEON III. *Treatise of the Past and Present Use of Artillery.*

THE FRENCH REVOLUTIONARY WAR — FORMATION OF AN AEROSTATIC CORPS — AEROSTATION WITH THE ARMIES OF THE SAMBRE AND MEUSE AND THE RHINE — A MARCH FROM MAUBERGE TO CHARLEROI — CROSSING THE MEUSE, AND THE MARCH TO BRUSSELS — GALLANTRY OF THE AUSTRIAN GENERALS — THE RECONNAISSANCE OF MAYENCE — THE COMPANY MADE PRISONERS OF WAR AT WUERTZBOURG — FOURCROY'S REPORT TO THE CONVENTION — M. LOMET'S MÉMOIRE ON THE SERVICES THAT CAN BE RENDERED TO TOPOGRAPHY — THE MOSCOW AEROSTAT — PROPOSITIONS DURING THE CRIMEAN WAR — THE ITALIAN WAR — SOLFERINO AND CASTIGLIONE — AUSTRIAN ENGINEER COMMITTEE — OBJECTIONS AND THEIR REFUTATION — AMERICAN WAR-BALLOON EQUIPAGE — TOPOGRAPHICAL REMARKS — THE BATTLE OF HANOVER COURT-HOUSE — TELEGRAPHIC COMMUNICATION FROM BALLOON — MR. LOW'S PROPOSITION FOR CROSSING THE ATLANTIC.

IN the early part of the Revolutionary War, when ingenuity and science were so eagerly called into active exercise, the *savans* of the French Academy recommended the use of balloons as a means of reconnaissance. Under their auspices an Aeronautic School was established at Meudon.

It was formed with the utmost secrecy (says Mr. Wise), so that the powers opposed to the French could not avail themselves of its advantages, until the first projectors had already used it in such an effective manner as to greatly paralyse them. In order to have it at once facile and useful, it was necessary to reduce it to systematic practice. The management of the Institution was committed to the most eminent philosophers of Paris. Guyton de Morveau, the celebrated French chemist, and Colonel Coutelle superintended its operations. Fifty young military students were admitted to this school for training. A balloon of thirty-two feet in diameter was constructed, of the most durable materials, as a practising machine for these pupils. Although the original plan of generating hydrogen gas was by decomposing water with the aid of oil of vitriol, and iron filings and borings, De Morveau introduced another method in this case. For this purpose, six iron cylinders were fixed by masonry in a simple kind of furnace, each of their ends projecting, and covered with an iron lid. Two sets of metal tubes were also inserted into these lids, one for conveying in the water, and the other for carrying off the gas which was formed from the water. The cylinders being charged with iron turnings, and brought to a red heat, the humidity of the water was instantly converted into steam, whose expanded particles were soon decomposed, by the oxygen uniting with the red-hot iron, forming an oxide of iron, while the hydrogen was thus freed, and forced out by its own pressure from the other tube; and from thence it passed through a washer of lime-water, to make it deposit its carbonic acid gas, that might adhere to it, when it was perfectly pure and ready for the balloon. By this method they procured, at a very moderate expense, a quantity of gas sufficient to inflate a balloon thirty-two feet in diameter, which holds 17,000 cubic feet, in the space of four hours. The practising balloon was kept constantly full, so as to be at all

times ready for exercise; and, when not in use, it was fastened to the terrace of the lodge, in the open air. Whenever the weather was fair the colonel of the corps and a pupil seated themselves in the car, when the machine was suffered to rise five or six hundred feet, arranged by cord and windlass. This primary movement became an object of great interest, from the advantages it seemed to possess. Paris, at this time being the great military focus of the world, could by these means view with Argus eyes the movements around the great metropolis. Telegraphic communication was greatly facilitated to the governmental centre by the aeronautic observers. A balloon was also constructed for this school, which, when filled with hydrogen, required the strength of twenty men to keep it to the earth. It could, after the lapse of two months, without, in the mean time replenishing it with gas, raise into the air two men, with necessary ballast and all the instruments of observation. Colonel Coutelle constructed balloons specially appropriated to the different divisions of the French army, viz., the "Entrepenant" for the army of the north, the "Celeste" for that of the Sambre and Meuse, the "Hercule" for the army of the Rhine and Moselle, and the "Intrepide" for the memorable army of Egypt.

In June, 1794, Coutelle ascended in the war-balloon "Entrepenant," to reconnoitre the hostile army, just before the battle of Fleurus, accompanied by an Adjutant and General. They rose to a height of several thousand feet, with their windlass-machinery so arranged that they could make it stationary at any given altitude. They mounted twice in the course of that day, and remained up each time about four hours. During the second aerial *reconnaissance*, they were discovered by the enemy, causing consternation and surprise within their lines. A brisk cannonade upon the aerial man-of-war ship, however, soon followed; but the observers, not being very high at the time, soon elevated themselves to a point at which they finished their observations, in defiance of the enemy's cannon. They descended safely, and by the signals communicated to General Jourdan, he was enabled to gain a speedy and decisive victory over the Austrian forces on the plains of Fleurus.

The following is the report of Colonel Coutelle on military aerostation with the armies of the Sambre and Meuse and the Rhine (1794-5):—

The Committee of Public Safety assembled "a Commission de Savans," among whom were Monge (the inventor of descriptive geometry), Berthollet, Guyton de Morveau, Fourcroy, Carnot, &c. Guyton proposed to make the aerostat useful to armies as a means of observation. This proposition was accepted by the Government, on condition that sulphuric acid should not be used, all sulphur being required for the manufacture of gunpowder. The Commission then suggested the use of decomposed water.

This experiment, made by the celebrated Lavoisier, and repeated in our laboratories, only gave small results. An experiment on a large scale was necessary, as twelve or fifteen thousand cubic feet of gas was required on the shortest notice.

The experiment succeeded. I made five or six hundred cubic feet in presence of the Commission; who were so satisfied, that I received the order next day to go with utmost speed to Mauberge, and propose to General Jourdan the employment of an aerostat for his army.

I arrived at Beaumont, covered with mud; for I was obliged to go eighteen miles without drawing rein, by such bad roads that artillery would have sunk to the axle-trees. The officer* to whom I delivered my order could not understand my mission, nor the resolution of the Committee of Public Safety, and still less an aerostat in the middle of the camp. He threatened to have me shot, as a suspicious character, before listening to me; but ended, however, by relenting and complimenting me on my devotion.

The army was at Beaumont, eighteen miles from Mauberge, from which post the enemy were only one league, and could attack at any instant. The General made me observe this, and ordered me to return and report it to the Committee. I arrived at Paris after spending two days and a half on this expedition.

The Commission were then aware of the necessity of some preliminary experiments with an aerostat fit to take up two people, so they put at my disposal the chateau and garden of Meudon. Conté assisted me; after some months all was ready, and I gave notice to the Commission that they might witness the first experiment of a balloon held by two ropes.

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* This was Duquesnez, who held the office of Commissioner of the Convention with the Army of the North, and whose singular duty it was to "see that soldiers went into battle, and to force the generals to conquer under menace of the guillotine." Duquesnez was at dinner when Coutelle arrived, he knew nothing of the orders of the Committee of Public Safety. "Un ballon!" said he, "un ballon dans le camp! Vous m'avez tout l'air d'un suspect, je vais commencer par vous faire fusiller." This hot-tempered Commissioner at length listened to reason, and sent Coutelle to General Jourdan.

When seated in the car, the Commission gave me directions as to the signals and observations to be made, and I rose to the limit of the ropes (590 yards). Being at the time about 760 yards above the Seine, I could perfectly distinguish with the glass the seven bends of the river as far as Meulan. On descending, I impressed on the Commission the necessity of two people making the ascent, one of whom should be the chief directing the operations. Three ropes are useless.

A few days after, the Government Committee gazetted me Brevet-Captain commanding the Aerostatic Corps in the Artillery-service attached to the General Staff. I received at the same time orders to organise a company of thirty men, including a captain, lieutenant, ensign, and non-commissioned officers, the sergeant-major to act as paymaster, and to proceed to Mauberge without delay.

The eighth day I left with an officer, after giving the directions to the few soldiers I could collect to start for Mauberge.

Arrived at Mauberge, my first care was to select the spot, construct the kiln, find firewood, and arrange everything, whilst awaiting the arrival of the aerostat I had tried at Meudon.

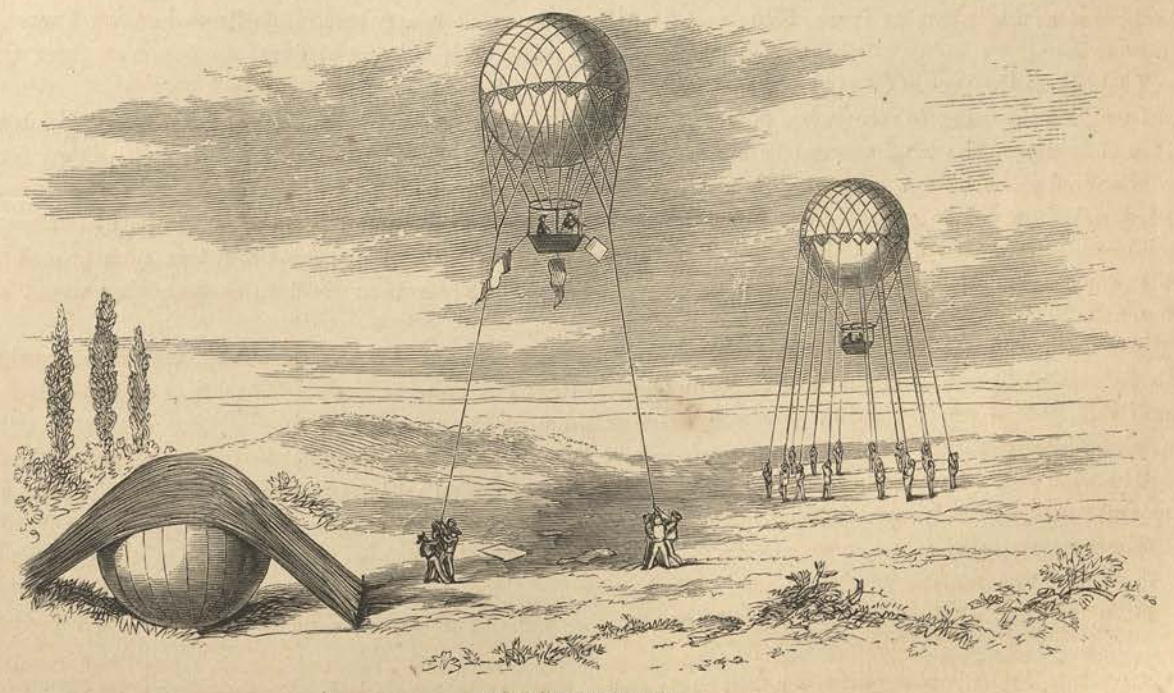
The different branches of the service knew not how to regard soldiers, who were not apparently of the army, and of whose use they were ignorant. The General commanding at Mauberge ordered a sortie to be made on the Austrians intrenched within gunshot of the place. I asked to be employed with my troops in this attack. Two of mine were severely wounded, and the ensign shot; we re-entered the place with the rank of soldiers of the army. A few days afterwards, my equipages arrived. I lit the fire of the kiln, and the aerostat was filled in less than fifty hours. I then rose as often as ordered by the General, with an officer of the Staff, to examine the works of the enemy, his position, and his forces.

We observed his daily progress, till, on the fifth day, a 17-pounder, masked in a ravine within easy distance, fired at the balloon as soon as it rose above the ramparts. The ball passed over our heads, the second was so near I thought the aerostat was perforated, and the third fell below us.

When I gave the signal to haul down, my company did it with such vigour, that only two more shots could be fired; next morning the piece was no longer in position.

Occupied during twenty days with incessant work, night and day, from the number of observations, nothing was prepared for carrying such light and delicate equipage over ramparts and ditches, and enter on a campaign; yet I received an order at midday to proceed next day to Charleroi, a distance of twenty-four miles by the road I should have to follow, to avoid the narrow streets of the villages.

Experience had shown me that it required both force and dexterity to resist the wind and prepare for gusts.



FRENCH WAR-BALLOON.

I employed the night in arranging twenty ropes around the equator of the netting, which I made as firm as possible (*see figure on page* 281), and to each of my men I gave a rope, which he was to tighten or loosen according to signal. We started at daybreak, passing close to the enemy's videttes.

I kept the balloon at such a height that the cavalry and military equipage could pass underneath the car; my men holding the ropes marched on either side of the road.

The car contained two ropes for ascension, a large sailcloth that served to keep the balloon on the ground during the night (*see figure*), also to lower the balloon when the wind was too strong; some pickets, mallets, and pickaxes, with sacks and signals. The balloon could raise in calm any weight under five hundred pounds; so I carried in my car from ten to twenty pounds of sand, and diminished the weight according to the wind, or threw out if a gust surprised me. At Mauberge a gust carried me on to the point of a church-spire; but a bag of sand, of the weight of twenty pounds, thrown quickly out, caused me to rise above it.

After making a reconnaissance on the road we arrived at Charleroi at sunset, I had time before dark to reconnoitre the place with a General officer. The next day I made a second reconnaissance in the plain of Jumet, and the following day the aerostat was in observation with a General officer from seven to eight hours.

At 3 P.M. (the attack had commenced at 3.30 A.M.), General Jourdan ordered me to rise and observe a point he noticed in his plan; whilst I was making the observation with an officer in my company (there being no Staff officer at the General's disposal), a battalion passed between the ropes of the balloon, and I heard several say in joke that they were beating a retreat, and a voice, "If we are beating a retreat the balloon will not long be there."

Many Austrian officers, who were at the battle of Fleurus, have subsequently assured me that many shots were fired at the balloon. After a few more reconnaissances we followed the movements of the army.

Near the heights of Namur a gust carried the balloon against a tree and tore it. I returned to Mauberge, a distance of twenty-four miles, and when the new balloon arrived I filled it.

After many more reconnaissances with the Generals who commanded the different corps d'armée, we crossed the Meuse by boat and directed our course to Brussels. Here a new incident awaited us at the gates of that town: a gust of wind carried the balloon against a stack of wood, and slightly tore its lower hemisphere; but little gas escaped, so I entered the Park, and with a rope made a circle which was respected by the curious spectators. The accident was there repaired, and I rejoined the army on the fourth day. Afterwards, at Borcette, near Aix-la-Chapelle, a sojourn of some months allowed me time to construct a new kiln, which I had hardly completed when I was recalled to Paris to form a second company, which I was ordered to conduct to the army of the Rhine, where the reconnaissances had the same success.

The Generals and officers of the Austrian army failed not to admire this method of observing them, which they said was as ingenious as it was bold; and I received the most hearty congratulations whenever I was with them. "It is only Frenchmen," they repeated, "who are capable of imagining and executing such an enterprise;" when I told them they could do as much.

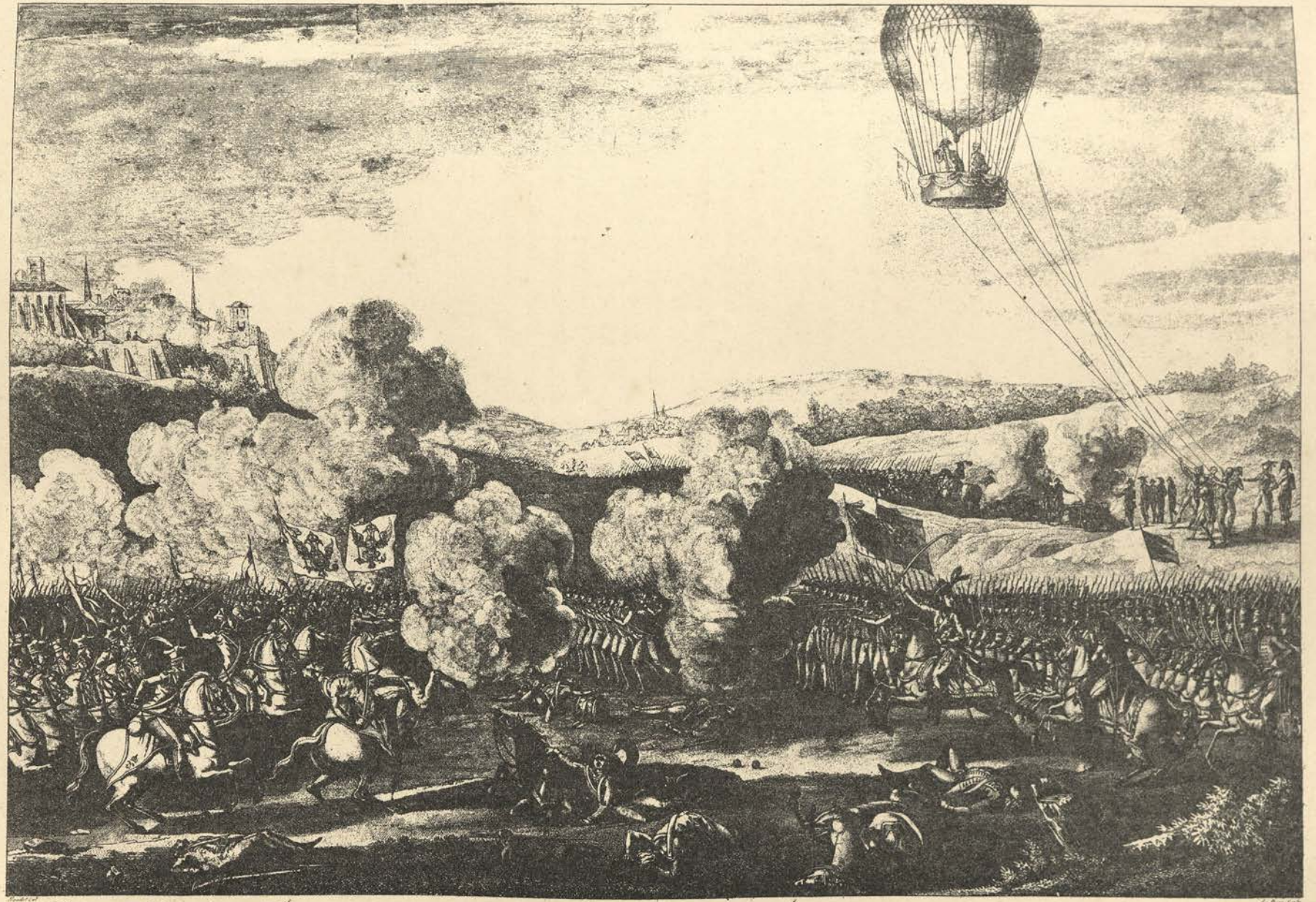
I received the order to reconnoitre Mayence, and I posted myself between our lines and the place, within easy distance of its guns; the wind was strong, and to offer more resistance I rose alone, with a diminution in my favour of two hundred pounds. I was at more than two hundred and thirty yards from the ground, when three successive squalls knocked me to the ground with such force that many of the bars that strengthened the bottom of the car were broken. On each occasion the balloon rose with such force and rapidity that thirty-two men at each rope were dragged some distance. It is therefore clear that had the ropes been fixed to anchors they would have broken.

The enemy did not fire. A General and some of the Staff came out of the town, waving white handkerchiefs, which I signalled to our head-quarters, and our General went out to meet them. When they met, the Austrian General said, "*Monsieur le Général, je vous demande en grâce de faire descendre ce brave officier; le vent va le faire périr; il ne faut pas qu'il soit victime d'un accident étranger à la guerre: c'est moi qui ai fait tirer sur lui à Mauberge.*"

The wind fell. I was able to ascend again, and on this occasion without glass I could count the cannon on the ramparts, and see the people walking in the streets.*

The enemy's soldiers, when they saw some one observing all they did, were discouraged by the thought that each movement was remarked; our soldiers, on the other hand, found new courage from what excited both their admiration and their confidence. In our toilsome marches none of my corps could be allowed to leave the ropes,

* See note in Appendix of the use of a balloon in the passage of the Rappahannock, 1863. An extract from Colonel Macdougall's 'Modern Warfare.'



Bataille de Fleurus gagnée par l'Armée Francaise, le 8 Messidor, de l'An 2.

Commandée par les Generaux Jourdan Le Fevre, et Jatri: Contre l'Armée Imperiale; Commandée par Cobourg, et Beaulieu.

Photo zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H. Helsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director

and so it happened that we found refreshments prepared for us, and frequently the light infantry soldiers brought us wine.

We were encamped before Mannheim, on the banks of the Rhine, when the General in command ordered me to cross over with a flag of truce. As soon as the Austrian officer knew that I was in command of the aerostat, I was overwhelmed with questions and compliments. "*Monsieur l'Ingénieur Aérien*," said a superior officer, "*les Autrichiens savent honorer les talents et la bravoure ; vous seriez traité avec distinction. C'est moi qui vous ai aperçu et signalé le premier, pendant la bataille de Fleurus, au Prince Coburg, dont je suis l'aide-de-camp.*

I observed to him that I ought not, according to custom, to be prohibited from entering the fortress, as I could by rising on the other bank survey the whole. The General in command sent me leave next day to see the place, if I had my General's consent.

The rocking is troublesome, and increases with the force of the wind, and sometimes prevents the use of glasses; but I must remark that one can see the movements of infantry, cavalry, and artillery with the naked eye; and at Mauberge, Mayence, and Mannheim I could count the pieces on the redoubts and ramparts without any extraneous assistance.

One has also to accustom oneself to the noise the balloon makes after the wind has blown one side concave, and it assumes again with rapidity its globular form, from the elasticity of the gas. I am not aware of any accident from this cause. During one reconnaissance on the banks of the Rhine, ague seized me for the first time, followed by a violent fever, from which I nearly died at Frankenthal, where I had a kiln. My lieutenant took command of my company, and passed the Rhine; on the first night it was torn and rendered useless. The aerostat commanded by Captain Hammond (or No. 1 Company of the Aerostatic Corps), that many shells and balls could not compel to descend at Ehrenbreitstein, was riddled by bullets near Frankfort. This company were made prisoners of war at Wurtzburg, in Franconia, and then joined the expedition to Egypt.

Being obliged to take sick-leave, I was hardly convalescent when I returned to Paris. I was raised to the rank of "Chef de Bataillon," and continued my duties at Meudon.

All the movements of an aerostatic corps should be done in silence. The correspondence is effected by signals attached to the sides of the car, and was devised by Conté, director of the aerostatic establishment at Meudon; the aerial observers being instructed by signals stretched on the ground.

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EXTRACT OF A REPORT OF FOURCROY TO THE CONVENTION NATIONALE (1795).

One of the discoveries which has had the most astonishing effects, and strikes the imagination by the position it gives to man, by raising him on the wings of the wind, is the aerostatic machine, which to the inventor has only been worth a decoration since become ridiculous by your laws, but the discovery of which has always received the homage of your words; and has since become for your Committee a new instrument of war, which our enemies have recognised as the pioneer to victory. The Convention will learn with interest that many *savans* have devoted ten months of zealous study to perfecting the art of aerostation, and to render it of easy use in camps, fortresses, and even on the theatre of war. Their researches have furnished a new means to produce at little cost, and with materials that are universal, the light fluid that expands aerostats, and even fills those of the largest dimensions.

Their foresight has caused them to take advantage of the latest mechanical discoveries, and also of those improvements in manufactures that enable silk to be made at Lyons of quality hitherto unknown, combining lightness with strength. The Aerostatic Corps has many companies; new manœuvres for the regular service of these new instruments of war have been devised, and the Republic possesses at this time a new Institution that thirty-four ascents have already compelled our enemies to admire, without having yet been able to imitate.

The Committee are occupied incessantly with the necessary measures for multiplying these precursors to victory, and soon all our armies will have complete aerostatic companies, with tents and rigging, which will be as necessary to them as parks of artillery. Their construction is now being pushed rapidly forward, and young citizens from the military school are instructed in the manœuvres necessary for military aerostation. All will soon be ready to show the enemies of the South, like those of the North, what strength is given to Liberty by the Genius and Art of France.

The following is an extract from a 'Mémoire' published in l'An X. (1803), by M. Lomet, on the use of balloons for topography as well as for military reconnaissance :—

Aerostats afford at will, in presence of the enemy, one or many points of observation, from whence one may reconnoitre the position he occupies, study his movements, judge of his numbers, and perceive the smallest details in his manœuvres.

One may conclude that these machines will become of indispensable use in war, as they have there established a method, till recently unknown, of gathering those observations that can instantaneously determine the success of the battle, aid the dispositions for a vigorous defence, or at least make known the favourable moment for retreat. To recall to mind the use that can be drawn from aerostats by the army, I need only mention the happy experiment on the field of Fleurus.

The Committee of Public Safety, and after them, the Executive Directory, thought the use of aerostats for military reconnaissances should be studied and practised in time of peace. They desired also their employment in the construction of geographical maps, or, at least, in filling in the intermediate details of surface between points geometrically determined. Ordered to make experiments relative to these various uses, I give an account of the chief results :—

On ascending, the aeronaut's first object is to measure the angles between the different points on the ground. This cannot be done with the theodolite, on account of the motion of the aerostat; another instrument, suspended like a mariner's compass, was next tried. It was expected to measure not only the angles from the centre, but also the inclination with the horizon; it did not however succeed, so the sextant was tried. This instrument left nothing to be desired, not only for the celerity, but also for the facility and precision of the observation; but it has this drawback, it gives no indication of the angles with the horizon.

In military reconnaissance, however, and other maps, in which the outline of the surface suffices, simple observations with the sextant are enough, as it furnishes the means of easily taking in a great extent of country; but it is not the same with observations that require more exactness, in which it is necessary to know the inclination of the angles from the horizon as well as from the centre.

This is how I have endeavoured to accomplish these requisites. * * * * The instrument, arranged as we have described, has produced in our experiments all the effect that could be expected. This invention is as simple as it is successful. * * * * * *

In conclusion, M. Lomet states that much experience is necessary, and that the art of aerostation combines properties as valuable as they are undeniable for the use of topography and military reconnaissance; that its improvement may cause new and unthought-of benefit to other sciences; and that it would also be impolitic to neglect these machines, or not to throw all the light derived from meditation and experiment upon them.

We end our memoir with a remark on their military use. The enemy will not fail to oppose to the creative industry of France an industry of imitation; they also will have their aerostats and aerostatic corps.* The influence of this innovation to war is of a kind that is rapidly developed, and soon it will not be exclusively in favour of any nation; but the art of aerostation will then have acquired a more general interest, because at that time it will have become one more element in the hands of men for opposing brute force with genius and industry. This cause should therefore excite all the friends of humanity to aid its improvement.

Two of Colonel Coutelle's balloons may still (1856) be seen, the one in the Kaiserliches Zeughaus, in Vienna, and the other in the riding-school at Metz.

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* An instance occurred in 1812, when, on entering Moscow, the French soldiers found in the Castle of Voronzoff a large aerostat, bearing many thousand pounds of gunpowder, which was to have been launched upon them. General Count Philip de Segur says, "This prodigious balloon was constructed, by command of Alexander, not far from Moscow, under the direction of a German artificer. The destination of this winged machine was to hover over the French army, to single out its chief, and destroy him by a shower of balls and fire. Several attempts were made to raise it, but without success, the springs by which the wings were to be worked having always broken."—*History of the Expedition to Russia undertaken by the Emperor Napoleon.*

Many of the Austrian soldiers at Fleurus said, "How can we fight against these republicans, who, out of reach, see all that passes beneath?"

Carlyle has given a humorous description of this scene. "Hangs there not in heaven's vault some prodigy seen by Austrian eyes and Austrian spy-glasses, in the similitude of an enormous wind-bag? . . . . By Heaven! answer spy-glasses, it is a Montgolfière, a balloon, and they are making signals! Austrian cannon battery barks at this Montgolfière, harmless as dog at the moon."

Napoleon did not, however, give this branch of the service much encouragement; for, after making use of them in Egypt, he allowed the Meudon establishment to exist without support till 1802 or 1804, and then abolished it. The French historian of aerostation (Depuis Delcourt) says that he had an antipathy to it ever since the remarkable omen at his coronation. An attempt was made to recreate this corps in the African campaign of 1830, but no opportunity occurred for its use. The Austrians are said to have employed reconnoitring balloons before Venice, in 1849, and the Russians in observing from Sebastopol.

The following is an extract from the 'Royal Engineers' Papers,' vol. xii., New Series, "On the Uses of Balloons in Military Operations," by Lieut. G. Grover, R.E., read at Chatham, 23rd April, 1862:—

There appears no reason, however, why balloons should not be used at moderate elevations to assist reconnoitring officers (by virtually extending their horizon) in obtaining the required information concerning the nature of the surrounding country and the movements of the enemy. They need not necessarily be within range of the enemy's projectiles, and a slight elevation would probably be found sufficient, when it is remembered that at the altitude of about 500 feet objects may be plainly distinguished on a clear day at a distance of twenty miles. This is particularly pointed out by Sir William Reid, who, when Governor of Malta in 1855, forwarded to the War Office a proposal from a Dr. Collings, to use "spy balloons" (as he called them) in the Crimea. This gentleman proposed to attain an elevation of 9000 feet, and though only *one* retaining rope was allowed for, the buoyancy required for this purpose would necessitate the use of a balloon seventy feet in diameter, if inflated with hydrogen gas having a specific gravity one-sixth that of atmospheric air.

Sir William Reid writes, "As balloons were successfully used more than sixty years back by a French army, they may perhaps be made of some use in the Crimea just now. To raise an observer even 200 or 300 feet above a fortified position might enable assailants to form more correct ideas on inner intrenchments than when only viewing such a position from a height of equal altitude." *

On the same day that the above letter was written by Sir William Reid, a similar proposition was made to the War Department by Mr. Shepherd, C.E., who designed the balloons and their inflating apparatus used during the search for Sir John Franklin's expedition. He states that he "can fit up a portable apparatus which will fill a balloon in about an hour, capable of taking up one man to a height of 600 or 700 feet, with rope to pull him down again."

Though the *principle* of these schemes was highly approved of by the officers to whom they were referred, and though similar propositions have been repeatedly made since that time, it is hardly necessary to mention that balloons have hitherto never been used for military purposes in the British service. Their absence from our field equipment is probably more attributable to an over-estimate of their defects, than to a non-appreciation of their advantages in military operations. That these defects are less serious than is generally supposed, I trust to be able

* Major-General Money, in a pamphlet addressed to the Right Honourable Charles Yorke, London, 1803, says:—"There are few men, Sir, in this country who know better than myself what use can be made of balloons in military operations, having been three times up with one, and expressly for that purpose. There never was a doubt in my mind on the subject; you see from them everything you wish to see."

to demonstrate in a future portion of this paper; but it is first proposed to examine the experience afforded from past tests of the use of balloons in actual warfare, so as to ascertain whether failure of precedents can be assigned as the reason for their not having been hitherto adopted in the British service.

An attempt was made to revive them in the African campaign of 1830, but there was no opportunity for making use of them. The Austrians are said to have employed reconnoitring balloons before Venice in 1849, and the Russians in observing from Sebastopol. The French again made use of them in the late Italian campaign of 1859, but this time the service was in charge of civilian aeronauts, the MM. Godard. Ascents were made from Milan, Gargonzola, Castenedolo, and the Castiglione Hills; and, according to the 'Times' Paris correspondent (in a letter dated 11th January, 1862), they proved great failures, as judged from a military point of view. However, the 'Times' special correspondent in Italy, Carlo Bossoli, thus writes concerning the balloon reconnaissance of the Austrian position at Solferino:—"On the day before the battle of Solferino, 23rd June, 1859, even with the best glass, nothing was seen at Solferino, which is ordinarily visible from the hills near Castiglione. In the afternoon, however, the brothers Godard tried from these hills a balloon ascent on a larger scale than some days before from Castenedolo. And on the Austrian side, where this ascent was seen, it is supposed that their plans were discovered by the Messrs. Godard."

The French reconnaissances in Italy do not seem to have effected any very great success, apparently in consequence of some official blunders or mismanagement. M. Prevet, who was commissioned as the Emperor's *mandataire* to organize the military balloon-service for the French army in Italy, applied to the aeronauts Godard for their assistance in the undertaking. Though they were anxious to construct a war-balloon especially adapted to the requirements of the service, yet (according to their own account) the *mandataire*, who wished to use as little as possible of the 50,000 francs with which he had been supplied for the necessary expenses, desired them to set out at once with such simple apparatus as they happened to have by them. However, the experiments they conducted at Milan induced the Emperor to order the construction of a regular war-balloon, and in the mean time the Montgolfière in the aeronauts' possession accompanied the army. It was this balloon which made the ascent from Marshal M'Mahon's head-quarters at Castiglione on the day before the battle of Solferino, and (as the Godards express it) the results were quite insignificant, though the moral effect upon the troops was great. It is probable that Marshal M'Mahon would have been better pleased with less moral effect and more tangible realities; the actual war-balloon only arrived at Solferino when the articles of peace were being signed. This machine appears to be well adapted to the purpose for which it was made, and it is unfortunate that no opportunity was afforded for a practical test of its utility in the field. It is made of silk, holds about 30,000 cubic feet of gas, has buoyant power sufficient to raise three men to an altitude of from 1000 to 1200 feet, will retain its gas for a whole month, and photographs have been often taken from it on a calm day by M. Nadar. It can be inflated in one hour by the ordinary illuminating gas (carburetted hydrogen) when near a town, and in the same way by hydrogen manufactured from a special apparatus for field-service. After being inflated at Milan, it was moved to Gorgonzola, a distance of twenty miles, and it then remained for two days at the artillery park without suffering any perceptible loss of gas. These details have been supplied me by the MM. Godard themselves, to whose courtesy I am indebted for much information on the subject generally.

One of the most interesting points of consideration with reference to the employment of military balloons is the question concerning the respective merits, for the purpose, of Montgolfières (smoke-balloons), or Charlières (gas-inflated balloons). The French reconnaissance at Castiglione was made from a Montgolfière, as has been already stated, but the MM. Godard, who made this ascent, and have practically tested both methods, express a strong opinion against this species of balloon. Without a cumbrous furnace in the car it will remain stationary in the air only for about five minutes; and even then it is scarcely capable of sustaining one aeronaut, in consequence of the high specific gravity of the inflating gas. If it be freed from the weight of a retaining rope, and consequently untethered to the earth, a reconnaissance of about twenty minutes' duration would be possible, supposing the wind to blow in a direction from the enemy. The least wind hinders its inflation, which may, under ordinary circumstances, be made in about twenty minutes. This rapidity of inflation is unquestionably a strong point in favour of Montgolfières; but the MM. Godard say that out of six ascents recently advertised to take place from the Pré Catalan at Paris, only two ultimately succeeded. Of course the objection on the score of low buoyant power might be obviated by increasing the dimensions of the machine, but then it would be of an almost impossibly gigantic size. The Austrian Engineer Committee state that a Montgolfière, of the very slightest useful power, must have a

diameter of sixty feet, the contents being upwards of 113,000 cubic feet.* At the same time they consider it infinitely preferable for military purposes to the Charlière. A report on the subject by Lieutenant-Colonel Baron Ebner, of the Imperial Engineer Staff, thus specifies what he conceives to be the six necessary conditions of the war-balloon service:—1st. The balloon should be able to make an ascent soon after the order has been received. It would be of little use in the field if the preparations necessarily occupied half or even a whole day. 2nd. The ascent should not be prevented by a wind of average force (about 1 lb. upon the square foot). A free ascent is then out of the question, since the slightest breeze would drive the balloon from the place where it is wanted to observe. 3rd. An average height of 100 klafter (622 feet) may be assumed as the proper altitude, which is limited in the case where the balloon is attached to the ground, by the weight of the retaining rope. At this height a surface of ground of about twelve miles diameter (forty miles English) can be distinctly examined with a good field-glass. 4th. The number of persons making the ascent should be two at least. Only in the company of an experienced aeronaut is it possible for an officer to make a reconnaissance with the proper confidence. There is always danger of a sudden gust of wind or a bullet from the enemy tearing asunder the rope that retains the balloon, and thus changing its captive state into one of freedom; one at least, therefore, of the persons making the ascent should be fully capable of managing a balloon thus liberated. A trustworthy and experienced aeronaut is, therefore, an essential condition of the whole undertaking. 5th. The balloon should be in *telegraphic* communication with the ground, since it would take too much time to send written questions and answers up and down the retaining ropes. Hence two skilled telegraphists must be employed during the reconnaissance. 6th. Ascents should finally be practicable at any given spot, and as often as required. And these conditions, Baron Ebner considers, would not be properly fulfilled by the employment of Charlières, or gas-inflated balloons. The production of sufficient hydrogen by the action of sulphuric acid upon zinc or iron would be a complicated, unsafe, costly, and dilatory operation. Even the conveyance of hydrogen in a compressed state would be objectionable, since (if it were compressed to one-twentieth its ordinary volume) the metal casks would require at least 800 cubic feet of contents, and they must be strong enough to resist a pressure of twenty atmospheres. In this case there would be a saving in time, but a very considerable increase in expense.

No notice seems to have been taken by the Austrians of another method of generating hydrogen, viz., by passing steam over red-hot charcoal or iron-turnings, but they have evidently decided, as far as theory goes, in favour of Montgolfières as the proper species of balloon for military service. For the inflation, however, they propose hot air in place of the smoke of straw, wool, &c., as used by the first aeronauts. For the purpose of heating the air they employ a wrought-iron stove, something after the fashion of the boiler of a steam-engine; into this the air is driven by powerful bellows, and, after being brought to the proper temperature in parallel flues, it enters the balloon. To counteract the refrigeration which evidently would take place over the surface of the machine, either a lamp apparatus must be carried up in the car, or else an additional supply of hot air must be conveyed to the machine by means of a flue communicating with the earth.

The more then that we examine the investigations into the subject that have been conducted by foreign officers, the more do we learn, *not of what has been done, but of what has not been done;* the more do we become convinced that there has not been yet discovered a satisfactory system of military ballooning, one fit (that is to say) to satisfy all the evident exigencies of actual warfare.

The most recent instance of a successful balloon ascent for the purposes of military reconnaissance (conducted by the Federal Americans at Island No. 10) is thus noted by the 'Times' of April 14, 1862:—"A balloon reconnaissance was made on the 27th March by Professor Steiner, accompanied by Colonel Buford and Captain Maynardier, which established the fact that shells had been thrown at too great a range to be sufficiently effective against the Confederate batteries. This defect in mortar-practice has since been remedied." According to a subsequent account, this balloon was filled on a flat-bottomed boat and confined by a single rope. It attained an elevation of about 600 feet, and the reconnaissance is described as having been "eminently satisfactory." I think it may be deduced, then, from the foregoing historical account, that a very fair average of success has attended the use of reconnoitring balloons by different armies during the last seventy years.

* Mr. Coxwell's "Mammoth" Balloon, probably the largest Charlière ever constructed, is 69 feet in longitudinal diameter, and 55 feet in transverse diameter. It is composed of 48 gores, each 44 inches wide, and contains 95,000 cubic feet of gas. Mr. Green's celebrated "Nassau" Balloon, also a Charlière, contains 85,000 cubic feet of gas, having a longitudinal diameter of 60 feet, and a transverse diameter of 50 feet. It can raise 4000 lbs., including its own weight and that of all the accessories (about 1000 lbs.). The extreme breadth of each gore is 44 inches.

The following are some of the objections most frequently urged against such a practical application of them:—

1st. The chance of their being struck by the enemy's projectiles, and caused to fall suddenly in consequence of the escape of gas through the holes thus formed in the silk bag.

2nd. The size, weight, and consequent difficulty of transport attendant upon balloons with sufficient buoyant power to admit of their being attached to the earth by guy-ropes.

3rd. The difficulty of providing gas for their inflation when in the field.

4th. The difficulty of attaching to the army experienced aeronauts for the purpose of inflating the balloon, regulating its ascents and movements in the air, and taking general charge of it on service.

5th. The danger incidental to balloon ascents in general, even when undertaken by experienced and professional aeronauts.

1. In answer to the first of these objections, it may be stated that, even supposing the balloon to come within range of the enemy's fire, its descent upon being struck would not be effected so instantaneously or completely as is generally imagined. When the great Nassau balloon fell into the sea near Sheerness, in 1850, sixty rounds of ball-cartridge had to be fired into it before any perceptible effect was produced in its size by the escape of gas; each bullet passing right through the balloon, and thus forming two holes in the bag. If it were struck by shot below the level of the gas (and balloons are seldom perfectly full), of course not the slightest effect would be produced; and anyhow it is apprehended that, wherever the hole be formed, the balloon would retain sufficient buoyant power to admit of an easy and safe descent to the ground. In addition, it should be borne in mind that the aeronauts, if exposed to fire, could at pleasure descend to the earth, or ascend until out of range (as at Fleurus), provided that the length of guy-rope were sufficient for this purpose, and in all probability there would be few occasions in a campaign when it would be necessary to reconnoitre in this manner in exposed positions.

2. The size of the balloon depends of course upon two conditions—the nature of the gas with which it is inflated, and the weight it has to lift. A scheme has been already alluded to in this paper, which proposed to employ a balloon to elevate reconnoitring officers to a height of 9000 feet. To support one retaining rope of this length, a balloon seventy feet in diameter would be requisite; but if (as is proposed in this paper) an elevation of merely 600 to 700 feet be considered sufficient, a balloon with diameter of about twenty-eight feet will be found large enough for the required purpose, if filled with hydrogen gas having specific gravity ·166. The exact manner in which this dimension is calculated for the proper ascending power will be described afterwards; but, with reference to the portability of the machine, it may be remarked that the whole apparatus, together with that for the generation of gas, could be easily conveyed in a single Field Train waggon.

3. A specific gravity one-sixth that of atmospheric air has been allowed for the hydrogen to inflate the balloon (its specific gravity, when perfectly pure, being about one-fourteenth). That of coal-gas, which is usually employed in ordinary balloon ascents, is ·4; but, notwithstanding, its superior merits for the purpose are strongly advocated by the amateur aeronaut, Mr. Monck Mason, in his 'Aeronautica,' in consequence of "the greater subtlety of the particles of hydrogen, and the stronger affinity which they exhibit for those of the surrounding atmosphere."* Its greater lightness renders it, however, preferable in the present case, and the method of producing the gas in the field has now to be considered. Undoubtedly the quickest manner of doing so would be to obtain it by the action of dilute sulphuric acid upon zinc or iron, but the danger of carrying about large quantities of sulphuric acid is so great, that another method is preferable. The French evolved hydrogen for their war-balloons by passing steam over red-hot iron-turnings, but probably an improvement would be effected in this process by the substitution of charcoal, at a very low degree of red heat, for the iron-turnings,† the interior of the tubes having been previously

* For, since the rates of diffusion of gases vary inversely as the square roots of their densities—

Therefore, the diffusive power of coal gas : diffusive power of

| | | | | |
|---|---|---|---|---|
| pure hydrogen | :: | $\sqrt{\cdot 069}$ | : | $\sqrt{\cdot 45}$ |
| or | :: | ·255 | : | ·67 |
| or | :: | 1 | : | 2·627 |

† The production of hydrogen in large quantities by this process is described by the French chemist, M. Deville, in the 'Annales de Chimie et de Physique,' for January, 1861, but his gas contained

H 53·2 vols.
Co 40·3 „
$Co_2$ 6·5 „

Mr. Bloxam, of King's College, informs me that by passing steam over red-hot coke in an iron tube (whose interior had been previously oxidised by a current of steam) he obtained a gas composed of

H 81·6 vols.
Co 8·4 „
$Co_2$ 10·0 „

but even this gas (before being purified) would have a specific gravity almost double that required for the present purpose.

well oxidised by a current of steam; the charcoal presents several advantages, being easy to obtain in well-wooded countries, and requiring a lower degree of heat in order to prevent the formation of carbonic oxide. After the production of the gas, it would have to be purified by lime from any taint of carbonic acid gas, and it must be properly cooled before entering the balloon. Without experiment, it is almost impossible to form any definite idea of the time which would be occupied by this process in the production of gas in sufficient quantities, but it is probable that two or three hours would be found enough; and it is certainly preferable to the zinc and sulphuric acid method,* being safer both in use and transport, and requiring far less weight both of apparatus and materials.

4. For the management of the balloon about five or six Sappers would probably be sufficient, having been previously instructed in all the practical details necessary for the service, such as the method of putting together the gas-supplying apparatus and inflating the balloon, the management of the guy-ropes, repairing the balloon (in case of accident), &c. They should also make a few ascents with some experienced aeronaut, to be taught the method of using the valve, ballast, grappling-anchor, &c., in case they had ever to make an independent voyage; but all this practical knowledge might be easily acquired in two or three weeks, and the balloon service would then be solely in military charge.

5. The accidents that occasionally happen in balloon ascents are attributable mainly to the negligence and folly of the owners. The envelope or bag is often, for the sake of economy, constructed of cotton instead of silk, and this material (not being very durable in the first instance, and still more weakened afterwards by the action of the varnish and gas) wears out after a few seasons' use, and the slightest strain on the balloon tears open the stuff. The ropes too are frequently used in wet weather, packed up carelessly, and consequently rot; the result being that the netting or grappling-ropes, though sound in appearance and sufficient for moderate purposes, give way on any extraordinary tension, and the machine is no longer under the aeronaut's control. To some of these causes may be generally traced the occasional accidents that occur in balloon voyages; and as the ascents are generally advertised several weeks beforehand, in order that the spectators may not be disappointed, the aeronaut has to ascend at the fixed hour, frequently in a hurricane of wind, or under adverse circumstances, which would deter him from the attempt if he were in an independent position.

However, the percentage of accidents is excessively low in proportion to the number of balloon ascents made. It is conceived, therefore, that careful superintendence and examination should entirely preclude the possibility of any accident in the use of military balloons; and, as an instance of what proper care and attention will effect, it may be mentioned that the two aeronauts, Messrs. Green (father and son), have made between them some 930 ascents, in none of which have they met with any serious accident or failure.

In the consideration of the proper size, nature, &c., of a balloon fit for reconnoitring purposes, the wind may be assumed to exert the same pressure upon the balloon as it would upon a circle of similar diameter; for though theoretically a solid sphere presents only three-sevenths of the resistance to the air opposed by its generating circle, yet practically, in the case of a balloon, there would not be much difference, since it often collapses under the force of the wind, and presents a flattened surface, and at the same time the network of cordage in which it is encased catches the wind and increases the resistance very considerably.

Balloons also are usually constructed of a pear shape (having the longitudinal axis about one-sixth greater than the transverse), so that the network may be properly adjusted upon it, and consequently the surface presented to the action of the wind is somewhat larger than a hemisphere. Taking these points into consideration, the resistance of a plane circle twenty-eight feet in diameter may be allowed for, as sufficiently accurate for all practical purposes, this dimension having been stated in a former portion of this paper as being sufficient for a balloon to fulfil all the required conditions.

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* In 1855 Mr. Abel, Chemist to the War Department, designed and constructed such an apparatus to generate hydrogen for balloons from zinc and oil of vitriol. He writes:—"Possibly the so-called water-gas process, of American origin, might be modified so as to yield a gas sufficiently light for inflating balloons without the necessity of very extensive arrangements." In a later memorandum (extracts from which Sir John Burgoyne was good enough to communicate to me) Mr. Abel says:—"Portable apparatus have been constructed within the last few years for the production of oil or resin gas for illuminating purposes, and I have little doubt that some similar and efficient arrangement could be contrived for generating gas suitable for balloon inflation." He also alludes to the perfection of Wheatstone's method of magnetic telegraphy as being applicable to the communication of information from war-balloons.

The area of this circle being 615¾ square feet, the following Table shows the pressure it would have to sustain from different winds:—

| | Velocity per hour. Miles. | Perpendicular force on 1 sq. ft. lbs. av. | Pressure on a balloon 28 ft. in diameter. lbs. av. |
|---|---|---|---|
| Gentle, pleasant wind | 5 | ·123 | 75·73 |
| Brisk gale | 10 | ·492 | 302·95 |
| Very brisk | 20 | 1·968 | 1211·80 |
| High wind | 30 | 4·429 | 2727·117 |
| Very high wind | 40 | 7·873 | 4847·82 |

One-inch round wire-ropes might be employed with advantage as guy-ropes to retain the balloon to the earth, since they correspond in strength to the 2¾-inch hemp-ropes, and weigh exactly half as much. The breaking strain of this rope being two tons, its safe working power may be taken at half this weight, or one ton.*

Consequently, supposing there to be two guy-ropes, each 550 feet long (to allow for the curve and inclination caused by the buoyancy of the balloon elevated between the two), as the weight of each rope would be about 92 lbs., we have 4296 lbs. as the total available resisting force† against the pressure of the wind upon both balloon and guy-ropes, a degree of strength sufficient to resist even a wind blowing at the rate of thirty miles an hour. As this is considered the maximum velocity of wind in which a captive balloon can be safely used for observation (in consequence of the violent rocking and swaying of the car), there can be little doubt but that these guy-ropes would be sufficiently strong for their purpose. The following Table, then, details the weights to be lifted:—

| | lbs. |
|---|---|
| 2 guy-ropes (of 1-inch wire-rope) each 550 feet long | 184 |
| 2 men (at 11 st.) | 308 |
| Silk bag of balloon | 40 |
| Car, network, &c. | 150 |
| Instruments, &c. | 18 |
| Total weight | 700 |

And as the 28-feet balloon may be considered as a sphere, for the gas seldom fills the lower portion, its cubical contents may be taken at 11·494 cubic feet; and if inflated with hydrogen one-sixth the weight of the surrounding air, the ascensional force will be 11·494 × 62·5 = 718 lbs. (as 1000 cubic feet of air weigh about 75 lbs.), and consequently the balloon would rise with an ascending power of 18 lbs.‡

The above calculation of the suitable size for a reconnoitring-balloon has of course been made upon the supposition that hydrogen is obtainable from the proposed gas-apparatus with a degree of purity equal to a specific gravity of one-sixth. This could be only definitely determined by experiments, whose results might possibly modify the above figures, though not, it is anticipated, to any very considerable extent.

The balloon itself should be constructed of silk, and payed over with an elastic varnish. Cotton is sometimes used instead of silk, being less expensive,§ but it is not so durable, and soon wears out from the action of the gas

* It has been objected that this is too liberal an estimate of the safe working load of an iron-wire rope, in proportion to its breaking strain. It is the usual allowance to make for hempen ropes, but Messrs. Newall and Co., the patentees of the iron-wire ropes, allow only one-sixth in consequence of the uncertainty attached to the working of iron, which cannot be relied upon, being seldom perfectly homogeneous. Fairbairn, however, in treating of iron girders, allows as a safe load two-thirds of the ultimate breaking weight.

† Since force = 2 (1 ton − 92 lbs.)
= 2 (2240 lbs. − 92 lbs.)
= 4296 lbs.

‡ This ascending power would be sufficient for calm weather, but must evidently be increased (by diminishing the weight or other means) in proportion to the strength of the wind. For the pressure of a strong wind upon the balloon would obviously force the rope so much out of the perpendicular, that the balloon would attain a very slight elevation without considerable buoyant power and a great length of rope. Supposing 45° to be the maximum angle to be safely allowed for the rope's deflection from the perpendicular, in this case ascending power must = force of wind, and (strain on rope)$^2$ = 2 (force of wind)$^2$. The guy-ropes previously described are of considerable strength, chiefly in order to resist the violent jerks on the rope caused by sudden gusts of wind. Since the above was written, an account has appeared in the 'Times' (of April 29th) of an accident happening to an American reconnoitring balloon, at Yorktown, in consequence of the breaking of the retaining rope. This shows the advantage of providing guy-ropes of even an excessive strength.

§ A silk balloon of the above dimensions, with all its accessories complete, would cost about 250*l*. A cotton one would probably not cost one-third this sum.

and varnish. It entails also a considerable loss of ascending power, being in itself heavier than silk, and requiring about double the quantity of varnish, which increases its weight; besides, the subtle nature of hydrogen gas renders it advisable to use a material of a closer texture than cotton.

As the balloon is to be used for reconnoitring, the colour of the silk should be such as to render it invisible at a distance. Grey is the best for this purpose, but as the varnish would turn it almost black, it would be advisable to employ a white silk, and the varnish would then render it of a light-brown colour. Experiment alone can, however, determine upon many important points connected with the balloon-service, such as—

1stly. The most desirable arrangement of the gas-generating apparatus, and the quality as well as the quantity of gas which it would evolve in a given time.

2ndly. The best way of attaching a balloon to the earth, and of managing the guy-ropes.

3rdly. The resistance offered to the wind by the captive balloon and its retaining ropes.

4thly. The greatest velocity of wind in which a balloon can be safely retained to the earth and conveniently used for reconnoitring.

In conclusion, I would briefly recapitulate the different heads of the subject upon which this paper has treated. It firstly enumerated the various propositions which have been from time to time entertained for the employment of balloons for military purposes; these having been considered and reduced to one (that of reconnoitring), the various instances were described of their actual use in this capacity, and their employment in the English service advocated on the supposition that they would be found of similar utility to our armies.* The most customary objections to them were then considered, an inquiry made into the description of balloon best suited for the purpose, and those experiments noticed which appeared most necessary to ensure their efficiency and success.

I now add a Paper from the same volume, "On Balloon Reconnaissances as practised by the American Army," by Captain F. Beaumont, R.E., read at Chatham, 14th November, 1862:—

Preliminary Remarks.

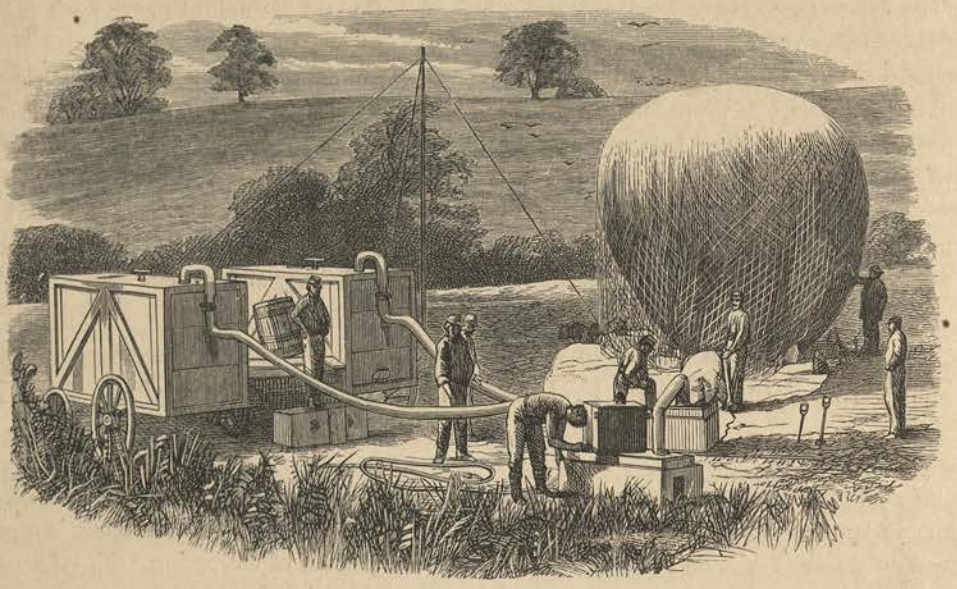
I have been asked to give some account of my ballooning experiences in the States of America, and I do so the more readily—firstly, because I believe that the art, even as it at present stands, is capable of being turned to practical account; and secondly, because the practice of ballooning, with reference to military manœuvres, being so little known, any remarks on the subject based on actual experience must, from that cause alone, be of some value; the nature of the art, moreover, is such that, to form a just appreciation of its applicability, one must turn, I may say entirely, to the results of experience on the subject, rather than to theoretical considerations connected with it. Lieutenant Grover's paper, which I have read, for all practical purposes exhausts the theory of ballooning; as, indeed, after having compared the specific gravity of the atmosphere within and without the balloon, and referred the result to the work to be done, there is little more to be said; always bearing in mind that to be on the safe side it is well to allow, for various reasons, a considerable excess of buoyancy over the weight to be lifted; the difference being made up with ballast adjustable at pleasure. In the case of a free ascension this is absolutely necessary, and circumstances may, at any time, render it imperative, even on a reconnaissance, to cut away the guys that hold the balloon to the earth. In the remarks I have to make I shall, therefore, with the exception of a few notes on details, at the end of this paper, confine myself to an account of the apparatus used by the Americans, and my own experiences in connexion with the reconnaissances I made.

American Apparatus.

There were two sizes of balloons used: one of small size, with a capacity of 13,000 cubic feet, corresponding to that twenty-eight feet in diameter, mentioned by Lieutenant Grover as suitable for the general purposes of a reconnaissance; and the other of about double this size. This 13,000 cubic feet gives about thirty feet as the diameter of the corresponding sphere; and to fulfil the requirements properly laid down by Lieutenant Grover, this is not too much. In practice he would find that his calculations—on the assumption that two people

* It is due to Mr. Coxwell to state that, throughout his aeronautic career of twenty years' standing, he has steadfastly advocated the employment of balloons for military as well as scientific purposes. His Letters in the *Times* on this subject, and his ascents in 1854, when he invented and used his telegraphic war-signals, sufficiently attest his zeal in this branch of aerostation. In his lectures and writings Mr. Coxwell has constantly spoken of aerial reconnaissance as a useful and practicable operation.

were to be lifted—would not allow sufficient buoyancy, for the following reasons: No allowance is made for ballast; three in place of two guy-ropes should be used, and they should be 1000 feet long at least, as that is by no means an unnecessary elevation to provide for. The larger sized balloon was, however, the one that the Americans decidedly preferred; it was constructed because the power of the other was found to be insufficient, and was used exclusively in place of the smaller one, which it superseded. I myself should decidedly think the larger size the best, for many reasons: amongst them, the extra cost is not nearly proportional to the increased size, nor is the trouble and expense of management; while size gives steadiness and safety when in the air, which is a great point to those using it; it is also frequently desirable to take up more than two persons, which the smaller one will only do (take up two persons), when quite full of gas, a condition happening even in its most perfect state only periodically, *i. e.* after it has just left the gasometer.



American War-Balloon.

Balloons.

The balloons were made of the best and finest description of silk, double sewn, and prepared with the greatest care; the summit of the balloon containing the gas-valve being made of either three or four folds of cloth, to ensure sufficient strength in that part subject to the greatest strain. The varnish, on which the success of the apparatus much depends, was a secret of Mr. Low's, the chief aeronaut; his balloons kept in their gas for a fortnight or more, and their doing so he laid to the fact of the varnish being particularly good; there was always a small amount of leakage, still at the end of a fortnight sufficient gas remained in the balloon to enable him to make an ascent without its being replenished. In balloons for military purposes this is an important point, as they must be kept ready to ascend at any moment. I have little doubt, however, that many well-prepared varnishes could be found to answer the purpose as well; the network covering the bag was gathered in, in the usual manner, and ended in a series of cords attached to a ring, hanging about level with the tail of the balloon, and from this hung the wickerwork car, the ring being about level with a person's chest when standing upright in the car.

Car.

The string for working the valve passed through the centre of the balloon, and coming out at the tail was loosely tied to the ring, to which were fastened the guys, three in number; thus the car, though swayed about by the motion of the balloon, hung always nearly vertically beneath it.

Generators.

The gas generators, two in number, were nothing more than large tanks of wood, acid proof inside, and of sufficient strength to resist the expansive action of the gas; they were provided with suitable stopcocks for regulating the admission of the gas, and with manhole covers for introducing the necessary materials. The gas used was hydrogen, and indeed for practical purposes, all things considered, there is none other that is nearly so suitable; its low specific gravity makes it a *sine quâ non* for a military aeronaut, as, independently of the ease with which it is produced, when a balloon is attached to the earth, it is of the first importance that it should

offer as little resistance to the air as possible, as its stability depends upon this point. The hydrogen was generated by using dilute sulphuric acid and iron; any old iron, such as bits of the tires of wheels, old shot broken up, &c., was used; so that it was necessary to provide only the sulphuric acid, which in large quantities is cheap, and with proper precautions very easy to carry.

Purifiers. The gas generated passed through a leathern tube into a lime purifier, and thence in a similar manner into a second, the action of the lime simply absorbing the carbonic acid and other extraneous gases, and sending the hydrogen quite, or very nearly, pure into the balloon. On leaving the generator its temperature was high, even the leathern pipe being so hot that the hand could hardly bear to touch it, but after passing the second purifier it was delivered, barely warm, into the balloon. The whole of the apparatus was so simple that nothing more remains to be said about it.

Use. In using it, the balloon is unpacked and laid in well-ordered folds on a carpet spread on the ground to receive it; the tail is then placed ready for connexion with the last purifier, properly charged with lime and water, and the connexion by leather pipes between the purifier and the generator having been established, the latter is charged; care must be taken not to complete the communication between the last purifier and the tail of the balloon until a clear stream of hydrogen is obtained, so as to avoid getting foul air into the machine.

Inflation. Under ordinary circumstances, in three hours from the time of the machine being halted, it can be prepared for an ascent; but this, should circumstances require it, might be shortened by employing two generators, and making a suitable alteration in the purifying arrangement. Such alteration, however, would rarely be necessary, as the balloon, when inflated, can, unless in very windy weather, be very readily carried; twenty-five or thirty men lay hold of cords attached to the ring, and march along, allowing the machine to rise only sufficiently to clear any obstacle that there may be in the way. I have frequently seen it carried thus without the least difficulty.

Balloon-Staff. The balloon-staff with M'Clellan consisted of one chief aeronaut, whose exact rank I could never quite make out, but it was not lower than a captain, nor higher than a brigadier; he was a civilian, and by profession an aeronaut; he was very highly paid, the same as a brigadier; and as the military rank, I believe in, America, is in some way attached to, and determined by, the pay received, I fancy Professor Low must have been a brigadier; at any rate he was a very clever man, and indefatigable in carrying out his work. By night or day, whenever the weather gave a chance of seeing anything, he was up, engaged on his observations; under him was a captain of infantry, who had been instructed previously at West Point (the American Woolwich) in the art of ballooning. The captain commanded the men, some fifty in number, attached to the machine, and superintended generally every arrangement in connexion with its inflation and use; he was also responsible for its transport, and that a due supply of materials was kept ready. The captain never went up himself; indeed he informed me that he liked the work below best, and confined himself entirely to it. Under the captain were a proportion of non-commissioned officers, who knew more or less of the management of it, and the men, who, besides having a sort of reverential awe of the machine, knew nothing whatever about it. Either one or two sentries were always on guard detailed from the captain's party, who had the strictest orders to allow no unauthorised person to approach.

Carriage. Each regenerator required four horses to draw it, and each balloon, with the tools, &c., four horses. The sulphuric acid it is essential to keep in a carriage to itself, but two horses will draw a sufficient quantity of concentrated acid to last for a long time. The undermentioned is a *résumé* of the balloon-corps and apparatus with General M'Clellan's army:—

BALLOON-CORPS.

| | |
|---|---|
| 1 Chief aeronaut,<br>1 Captain, assistant do.,<br>50 Non-Commissioned Officers and Privates, | Requiring 2 instructed men. |

APPARATUS.

2 Generators, drawn by 4 horses each.
2 Balloons „ 4 horses each (including tools, spare ropes, &c.).
1 Acid-cart „ 2 horses.

Whether the acid-cart was considered as part of the equipment of the balloon, or whether it was put into the first waggon that came to hand, I cannot with certainty say; but, of course, in a well-organised apparatus one

would be necessary. When the machine is inflated it is kept to the ground by a series of sand-bags, which are hooked on to the network, so that they can be disengaged at a moment's notice; thus confined, with the sentry to guard it, the machine remains unhurt in any weather short of a very violent wind-storm, in which case it should be hauled down altogether.

Application of Apparatus.

When it is required for an ascent, the captain and some thirty of his men get round the balloon, and carry it to the appointed place. The weight to be lifted having been put into the car, the ballast is so adapted that, including a couple of bags of sand, which it is not safe to go up without, there should be a buoyancy of, say, twenty or thirty pounds; the three guy-ropes having been attached, the men leave go of the car together and seize the ropes, one of which is led through a snatch-block attached to a tree, or some securely fixed object; the ropes are then paid out, and the machine rises to the required height; the motion of the guy-ropes is regulated by the aeronaut through the captain on the ground. Of course on the proper manipulation of the ropes, the convenience and safety of the aeronaut depends. I have been somewhat lengthy in the details of the working, but I have done so for the reason I have stated at starting, viz., that of the actual practice of balloon reconnoitring, little is, I believe, known. I will now say a few words on the application of the apparatus, and the results obtained from it.

Remarks on results obtained.

At the time I joined M'Clellan's army it was encamped on the Pamunkey River, one march below the now celebrated White House; it was pushing its way slowly up the Peninsula, driving the Confederates before it. The character of this part of Virginia is much the same as that of most parts of the agricultural districts of our own country, except that it is somewhat more undulating, and not nearly so highly cultivated, including woodland; perhaps not half the land is under cultivation; thus the character generally of the country is such as to render all reconnaissances, though the more desirable, very difficult to make. My first acquaintance with the balloon was made during the advance of the army; I had ridden forward from the main body, and joined General Stoneman's command, then occupying, for the first time, the west bank of the Chickahominy River. I found the balloon snugly ensconced in a hollow, protected from view by the hill in front, from the top of which a convenient position for an ascent was gained; the Professor's tent and those of the rest of the balloon-corps were scattered round, forming a small distinct encampment. I received from them great civility, and was afforded every opportunity for obtaining the information I desired. It may be thought somewhat odd that such a thing as a balloon should accompany the advance of an army, but there appeared to be no difficulty in its doing so, and, of course, it was more likely to be of use there than further to the rear. It was employed in making continual ascents, and a daily report was sent by the principal aeronaut to M'Clellan, detailing the result of his observations; of course in the event of anything very unusual being noticed a special report was made. The observer, by continual ascents, and by noting very exactly each time the position and features of the country below him, soon knows it, as it were, by heart, and a glance is sufficient to assure him that no change has taken place in the occupation of the country.

Topographical remarks.

The balloon never got more than about a mile nearer to Richmond than when I first saw it; it may therefore be interesting to describe generally the position of the army, and to state what the balloon did, and what it did not do. At that point the Chickahominy runs within about seven miles of Richmond; its nearest point is four miles and a quarter, at the village of Mechanicsville. It is in dry weather a sluggish stream, fordable at almost any place; but in wet weather it requires bridging, and sometimes, overflowing its banks, converts the valley in which it runs into a swamp a mile wide. High wooded ground borders the valley on either side, one of which was occupied by the Confederate army, with Richmond in its rear, it having retreated across the Chickahominy in front of M'Clellan's advance-guard; and the other bank by the main body of the Federals, who, with an army of one hundred thousand men, were extended over a front some twelve miles in extent, about the centre of which the balloon was stationed. So near to Richmond, the wished-for goal, it may be well believed that the results of the balloon ascents were looked for anxiously. From them were obtained the first glimpses of the Confederate capital, the capture of which, it was hoped, would virtually put an end to the war. Independently though of curiosity, most anxious inquiries were made from the observers in the balloon, as to the difficulties that lay on the road to Richmond. Were there any fortifications round the place? Where were the camps, and for how many men? Were there any troops in movement near the present position? and many other questions of equal importance. Now these questions were difficult to answer; and even from the balloon many of them could only be replied to with more or less uncertainty. From the balloon to the Chickahominy, as the crow

flies, was about two miles; thence on to Richmond, eight more. At the altitude of one thousand feet in clear weather an effective range of vision of ten miles could be got; thus the ground on the opposite side of Richmond could be seen; that is to say, houses, and the general occupation of the land became known. Richmond itself was distinctly seen, and the three camps of the Confederates could be distinguished surrounding the place.

Extent of vision.

Looking closer the wooded nature of the country prevented the possibility of saying whether it were occupied by troops or not, but it could be confidently asserted that no large body was in motion. In the same way, on seeing the camps round the place one could form a very rough estimate of the number of men they were for, but it was impossible to say whether there were men in them or not. Earthworks, even at a distance of eight miles, could be seen, but their character so far off could not be distinctly stated, though one could with certainty say whether they were of the nature of field or permanent works. The pickets of the enemy could be made out quite distinctly, with supports in rear, thrown forward to the banks of the stream. The country, from its thickly-wooded character, was peculiarly unfitted for balloon-reconnaissances; had it been a plain like Lombardy, the position of any considerable body of troops would have been known; as it was, it was only possible to say that they were not in motion: this could be confidently asserted, as, though they might remain hid in the woods while stationary, in marching they must, at some time or other, come into open ground and be seen.

Hanover Court-house.

During the battle of Hanover Court-house, which was the first engagement of importance before Richmond, I happened to be close to the balloon when the heavy firing began. The wind was rather high, but I was anxious to see, if possible, what was going on, and I went up with the father of the aeronaut. The balloon was, however, short of gas, and, as the wind was high, we were obliged to come down. I then went up by myself, the diminished weight giving increased steadiness, but it was not considered safe to go higher than five hundred feet on account of the unsettled state of the weather. The balloon was very unsteady, so much so that it was difficult to fix my sight on any particular object; at that altitude I could see nothing of the fight. It turned out afterwards that the distance was, I think, over twelve miles, which from one thousand feet, and on a clear day would in a country of that nature have rendered the action invisible; had the weather, however, been such as to have allowed the balloon to remain at its usual altitude the position of the engagement, from the smoke created, could have been shown; and it could have been said that no retreat had reached within a certain distance of the point of observation. It is quite possible, too, that with an altitude of two thousand feet the action might have been indistinctly seen, even at the distance of twelve miles.

York Town.

At York Town, where the Federals were attacking the line of works thrown across the Peninsula, between the York and James Rivers, the balloon was used continually. I was not there during the siege, but I did not hear that it was there attended with any particular benefit; as, though the works could be overlooked, irrespective of the indefinite feeling of satisfaction in being able to do this, no direct good actually accrued. This might have been imagined, as the prolongations of the various faces of the fortifications were known from the ground, and any movement in front of the works could, of course, be similarly made out. In the case of a siege, I am inclined to think that a balloon-reconnaissance would be of less value than in almost any other case where a reconnaissance can be required; but even here, if useless, it is at any rate also harmless. I once saw the fire of artillery directed from the balloon; this became necessary, as it was only in this way that the picket, which it was desired to dislodge, could be seen. However, I cannot say that I thought the fire of artillery was of much effect against the unseen object; not that this was the fault of the balloon, for, had it not told the artillerists which way the shots were falling, their fire would have been more useless still.

Telegraphic communication from Balloon.

During the first two days of the heavy fighting by the left of the army before Richmond, which ended in its retreat from the Peninsula, a telegraph was taken up in the car, and the wire being placed in connexion with the line to Washington, telegraphic communications were literally sent, direct from the balloon above the field of battle, to the government. In place of this the wires should have gone to the Commander-in-Chief's tent, or, indeed, anywhere better than to Washington, where the sole report of the state of affairs should have been received from no one but the officer in command of the army. If balloons or telegraphs are to be turned into means for dividing authority, every true soldier will look upon them as evils hardly unmitigated; but this with us need not be the case, for, as military machines, they would be solely under the control of the Commander-in-Chief.

General Barnard, the Commanding Engineer with M'Clellan, of whom I particularly asked the question, said that he considered a balloon-apparatus as decidedly a desirable thing to have with an army; but at the same

time it was one of the first incumbrances that, if obliged to part with anything, he should leave behind. I myself think that it is a thing which, if properly organised and worked, may be occasionally of considerable advantage, and occasions might occur when the absence of such information as the balloon gives an opportunity of obtaining, would be very bitterly felt. The observer from the balloon might, and most probably would, often enough, have nothing to report that the General did not know; but the time, on the other hand, might come when his report would contain facts, or satisfactorily confirm other information received, of such a nature that it would be invaluable. Nothing ought either to be accepted or condemned by its utility alone, but rather by its utility as compared with the cost of obtaining it. Now, of the utility under certain circumstances of overlooking a tract of country from a height of one thousand or two thousand feet, if necessary, there can be little doubt; at the same time the cost of being able to do so is so trifling that it would appear unwise to neglect the necessary steps to secure the advantage.

Opinion on value.

It may be of interest to mention that the Mr. Low referred to previously, is a man celebrated in America as a very daring aeronaut. He has performed the quickest journey on record, going by balloon from New York (I think it was) to near New Orleans, at an average rate of something like fifty or sixty miles an hour.

Mr. Low.

He is now building, and he told me he had very nearly completed, at Philadelphia, an aerial ship, with which he intends to attempt the passage of the Atlantic. From the earnest way in which he spoke, I felt convinced that he intended to try to carry out his scheme. His appointment to the army, and the distracted state of the country, obliged him to put it off for a while. If the Atlantic *is* ever crossed in a balloon, it will be the greatest feat by far in the shape of ballooning ever done, and may open a new era in the art. The theory that he goes upon appears to be correct, but he is a bold man who risks his life on an unsubstantiated idea. Mr. Low's ship is capable of taking up some ten or twelve persons, with provisions for a considerable time. It will be provided with all necessary apparatus, including a lifeboat, in case of his being obliged to change his element of support. The main part of his invention consists in a mechanical means of altering his elevation at pleasure, without an expenditure of ballast or gas; thus allowing him to remain an unlimited time in the air. If he is able to do this, and the apparatus holds together, I do not see how he can help making a wonderful voyage somewhere, whether across the Atlantic, or not, is another thing; nor do I think the venture would be so hazardous as I daresay most persons would consider it to be.

Aerial ship.

Mr. Low's theory respecting the direction he is likely to take appears correct; he, in common, I believe, with other aeronauts, has noticed that at various altitudes there are currents of air running in various directions. This is only probable, as a current in a fluid in one direction induces a compensating one in another. He proposes, therefore, to rise through successive currents of the atmosphere, as it were, until he finds one setting the way in which he wishes to go. These theories are somewhat visionary, and decidedly apart from the present question.

Theory of currents.

I shall conclude with a few remarks on the apparatus I would recommend for experimental purposes. Though for actual use I think the larger sized balloon the best, a capacity of thirteen thousand cubic feet would give sufficient buoyancy for experiment. I would alter, however, the shape of the envelope, as the one commonly used is the worst that could be devised for the purpose. In the case of a free ascent, shape matters little, as the machine must go with the wind; but when the balloon is anchored, it is of paramount importance to present the least possible surface to the action of the air. I would therefore give to the balloon a cylindrical form, and to the car a boat shape; and I believe that with the decreased resistance offered, such stability might be obtained as to allow of ascents being made in weather that, with the old shape, would preclude their being thought of. I would also have the whole of the network and the guys of silk, for the sake of lightness. Comparatively speaking, the first cost would be unimportant, and with care they would last a long time; while, if it were thought desirable, common cord might be used for ordinary ascents, and the silk ones brought out only in case of great altitude being required. A very thin wire would enable telegraphic communications to be kept up, if necessary, with the ground, and an alphabetical instrument would place the means of doing so within anybody's reach. The cost of an apparatus, perfect in every respect, would be about five hundred pounds, and one for experimental purposes might be got up for much less. The officer in charge of it would require to have practical experience; but his assistants might be men taken from the ranks, and a few hours would make them sufficiently acquainted with their duties.

Apparatus proposed.

The management of a balloon would seem to be a simple operation, and in perfectly calm weather, when everything goes well, so it is; but to feel confident under adverse circumstances, and to know exactly what to do, and how to do it when difficulties arise, can be the result only of experience. It has been supposed that the swaying motion of a balloon when tied to the earth would occasion a nausea in some people akin to sea-sickness; I do not think this would be the case (with me it certainly was not so); as, if the motion were so great, fear would in all probability overcome any other feeling, and at the same time under such circumstances it would be useless to think of observing.

Management.

I hope that the capabilities of balloons for military reconnaissances may receive a fair test with properly prepared apparatus; as, should it be suddenly required to use them, it is quite possible that want of practice would turn what should have been a success into a failure, and the faults of the executive would be borne by the system. I am confident myself, that under certain circumstances, balloons would be found useful; and no one could say after all, more against them than that, like the fifth wheel to the coach, they were useless.

Since writing the above Paper, an experiment has been carried out under the direction of the Ordnance Select Committee, a brief account of which is subjoined. Should the matter be proceeded with I shall be glad, on the completion of the experiments, to furnish a complete account of them.

On the question being brought before the Committee, the points they wished to establish were, first, that the fact of being able to overlook a tract of country from a great elevation really conveyed the advantages it was represented to do; and secondly, that there was nothing in the abstract situation which made it impracticable to reconnoitre from the car of a balloon.

With this object only in view, an ordinary balloon inflated with coal-gas would suffice; for, though unfitted for the purposes of a reconnaissance, still by choosing a calm day it could be used. Arrangements were therefore made for the hire of one of Mr. Coxwell's balloons, the necessary guy-ropes, gas, &c., being provided by Government. Aldershot was the place appointed for the ascent, as the gasworks happened to be conveniently situated, and, being a camp, there would be no difficulty in obtaining the concurrence of the military.

The authorities at the Horse Guards sent down orders to Aldershot that on a suitable day for the ascent the troops should be marched out in different directions, so that the value of the balloon as a point of observation, could be practically determined.

The first time appointed proved a failure, owing to the boisterous state of the weather, and the experiment was put off till the 13th of July. A field-day, however, for the Prince of Wales being fixed for the day after, the ascent took place on Tuesday the 14th. This so far modified the experiment, that no observations could be made on troops at the extreme distance at which it was anticipated they would be visible from the balloon.

The inflation was completed before eight o'clock in the morning, as the ropes and men being new to their tasks, it was considered advisable that a few preliminary ascents should be made. Mr. Coxwell had been no higher than about six hundred feet in a partial ascent; so that, except myself, no one had before been to the height of one thousand feet, which it was now proposed to attain; and, in a matter where any accident would in all probability carry with it serious consequences, it was proper to take every precaution. After inflation the balloon was carried to Thorn Hill, some three hundred yards from the gasworks, where the ascents were made. Three guy-ropes were used, one of which, stronger than the other two, was passed through a snatchblock fixed to the ground. The ropes were manned by a party of engineers entirely new to the work. No difficulty was experienced in either raising or lowering the balloon, the latter operation being done in about fifteen minutes from the height of one thousand feet. The greatest elevation reached was one thousand two hundred feet, and varied from that to one thousand feet, the balloon remaining for upwards of an hour and a half hovering over the camp. It was raised and lowered at pleasure, to enable the observers to be changed, and made some eight or ten ascents before it finally left the ground for its free flight.

As to the practical results obtained, the whole apparatus being unsuited for a war-balloon, the experiment afforded no criterion of the difficulty, or otherwise, of inflation on active service, where the gasometer would have to be carried, or, indeed, of the amount of stability a captive balloon might be capable of attaining. It was shown, however, that the transport of a balloon when filled was simple, and that it could be easily raised and lowered. A tract of country altogether unseen from the ground below was brought under observation, and the movements of troops on the top of Cæsar's Camp, otherwise out of sight, were clearly discernible. From the top of Thorn Hill,

the range of hills known as the Hog Edge, of which Cæsar's Camp is a part or adjunct, bounded the horizon on that side at a distance of somewhat less than two miles. From the elevation of one thousand feet, such a boundary no longer existed, the slopes of the opposite sides of the hills even being visible; in fact, an effective horizon of twenty miles' diameter was obtained—that is, no large movements of troops could take place within a radius of ten miles without being seen.

The day of the ascent was very still, exceptionably so; and how far it may be possible to overcome the difficulties which arise when the air is in motion, can only be determined by experiment.

My own idea, however, is, that with a properly constructed apparatus, balloon-reconnaissances may be made in a wind moving at any rate up to twenty miles per hour. The higher the wind, the less would, of course, be the altitude attained. However, a height of even two hundred feet is more than that of the spires of most churches—points of observation eagerly sought for when on the march in an enemy's country.

It would appear, therefore, that, under certain circumstances, the balloon affords means to an army of carrying with it a lofty point of observation; and, so far as the experiment went, it bears out the opinion I expressed on the matter in the paper to which this is an addendum.

With reference to the general subject of ballooning, I believe that some useful results might be obtained by photography applied from a balloon. A series of panoramic views might be taken by moving the machine along, which would be sufficiently intelligible to enable a draughtsman to make a sketch from, and which would have been taken far more rapidly than any survey on the ground could have been executed. This, however, is somewhat a matter of speculation; but I hope, should an experimental reconnoitring apparatus be got up, to be able to make some experiments in the matter.

The 'St. James's Magazine' has an amusing article "On Three Months with the Balloons in America," giving an account of how General Fitz-John Porter, when appointed to command the siege of York Town, was carried alone, and in a helpless plight (owing to an accident), above his army; the balloon, luckily, descended within his own lines.

A very able article "On the Defence of England against Invasion," by Lieutenant Steinmetz, of the Queen's Own Light Infantry, in 'Colburn's Magazine' for December, 1864, states:—"Nor should the service of aerostatics be beneath our attention. In spite of the opinions recently expressed as to the inutility of the contrivance, we contend that balloons can be made serviceable for reconnoitring purposes by a *skilful eye* and ready pencil, as demonstrated by Baron Reveroni de Saint Cyr, in his curious work before mentioned. A few hundred yards of elevation will be sufficient for all occasions, and the appliances of art can render the ascent safe and secure at pleasure."

Were half the power that fills the world with terror,
Were half the wealth bestow'd on camps and courts,
Given to redeem the human mind from error
There were no need of arsenals and forts.
The warrior's name would be a name abhorr'd,
And every nation that should lift again
Its hand against a brother, on its forehead
Should wear for evermore the curse of Cain.

LONGFELLOW.

If Europe should ever be ruined, it will be by its warriors.

MONTESQUIEU.

FROM WHENCE COME WARS AND FIGHTINGS AMONG YOU?

JAMES iv. 1.

THEY HAVE BLOWN THE TRUMPET, BUT NONE GOETH TO THE BATTLE.*

EZEK. vii. 14.

* See 'The Day after Armageddon,' a poem of Horatius Bonar, D.D.

# CHAPTER IX.

## METHODS OF DIRECTING AEROSTATS: WHAT HAS BEEN HITHERTO DONE, WITH SUGGESTIONS FOR FUTURE EXPERIMENTS.

"If we reason by induction, we arrive at one conclusion; if we reason by deduction, we arrive at another. This difference in the results is always a proof that the subject in which the difference exists is *not yet* capable of scientific treatment, and that some preliminary difficulties have to be removed before it can pass from the empirical stage into the scientific one."—BUCKLE'S *History of Civilisation.*

DR. LARDNER'S OPINION OF STEAM-NAVIGATION — THE ATLANTIC STEAM-NAVIGATION — THE FUTURE ANTICIPATED — HOW DO EELS AND SNAKES MOVE THROUGH WATER? — A CLASSIFICATION OF EXPERIMENTS — HANSON'S AERIAL CARRIAGE — THE 'WESTMINSTER REVIEW' ON AERIAL NAVIGATION — ELECTRO-MAGNETISM AND GUN-COTTON — KEDGING — THE FULCRUM — MEUSNIER, AN ENGINEER OFFICER — THE ERRONEOUS CALCULATIONS OF MONCK MASON — "THE RESISTANCE OF FLUIDS IS IN PROPORTION TO THEIR DENSITY" (NEWTON) — THE HELM — THE CENTRE OF GRAVITY — THERE ARE INSTANCES IN WHICH WE MUST CEASE TO IMITATE NATURE — A TABULAR SYNOPSIS OF THE ELEVEN DIFFICULTIES TO BE OVERCOME — MAREY MONGE'S 'ÉTUDES' — A COPPER BALLOON — AEROMOTIVES — THE OPINIONS AND IDEAS OF NADAR, BABINET, AND BARRAL.

As an example of the manner in which scientific men may sometimes err in their calculations, I will, preparatory to pointing out the errors of Mr. Monck Mason, who has hitherto been the most generally accepted authority in England on aerostation, cite a proverbial instance in the case of Dr. Lardner, the author of the well known Cyclopædia. The following extract appears in his 'Treatise on Hydrostatics,' edition of 1836, where he boldly asserts the impracticability of steam-navigation*:—

The resistance arising from the quantity of fluid displaced by the moving body may, therefore, be always greatly diminished, and in some cases rendered almost insignificant, by a proper adaptation of its shape. The accumulated resistance arising from the increased speed of motion is, however, an impediment which no art can remove. The fact that the resistance of a liquid to a body moving in it increases in a prodigiously rapid proportion in respect of the increase of velocity is one which sets an impassable limit to the expedition of transport by vessels moving on the surface of water. This property has long been well known, but it has received greatly increased importance from the recent improvements in the application of steam. If a certain power be required to impel a vessel at the rate of five miles an hour, it might, at first view, be thought that double that power would cause it to move at the rate of ten miles an hour; but, from what has been already proved, it will be perceived that four times the power is necessary to produce this effect. In like manner, to cause the vessel to move at the rate of fifteen miles an hour, or to give it three times its original speed, nine times the original power is necessary. Thus it follows that the expenditure of the moving principle, whether it be the power of a steam-engine or the strength of animals, increases in a much larger ratio than the increase of useful effect. If a boat on a canal be carried three miles an hour by the strength of two horses, to carry it six miles an hour would require four times that number, or eight horses. Thus double the work would be executed at four times the expense.

* In 1796 the Earl Stanhope himself pledged the sum of 9000*l.* for the success of some experiments in steam-navigation. See correspondence between him and the Lords of the Admiralty, given in Lord Stanhope's 'Life of Pitt,' vol. ii. p. 397.

These considerations place in a conspicuous point of view the advantages which transport by steam-engines on railroads possesses over the means of carriage furnished by inland navigation. The moving power has in each case to overcome the inertia of the load; but the resistance on the road, instead of increasing, as in the canal, in a faster proportion than the velocity, does not increase at all. The friction of a carriage on a railroad moving sixty miles an hour would not be greater than if it moved but one mile an hour; while the resistance in a river or canal, were such a motion possible, would be multiplied 3600 times. In propelling a carriage on a level railroad the expenditure of power will not be in a greater ratio than that of the increase of speed or of useful effect, entailing an enormously increased consumption of the moving principle.

But we have here supposed that the same means may be resorted to for propelling boats on a canal and carriages on a railroad. It does not, however, appear hitherto that this is practicable. Impediments to the use of steam on canals have hitherto, except in rare instances, impeded its application on them; and we are forced to resort to animal power to propel the boats. We have here another immense disadvantage to encounter. The expenditure of animal strength takes place in a far greater proportion than the increase of speed. Thus, if a horse of a certain strength is barely able to transport a given load ten miles a day for a continuance, two horses of the same strength will be altogether insufficient to transport the same load twenty miles a day. To accomplish that, a much greater number of similar horses would be requisite. If a still greater speed be attempted, the number of horses necessary to accomplish it would be increased in a prodigiously rapid proportion. This will be evident if the extreme case be considered, viz., that there is a limit of speed which the horses under no circumstances can exceed.

The astonishment which has been excited in the public mind by the extraordinary results recently exhibited in propelling heavy carriages by steam-engines on railroads will subside if these circumstances be duly considered. The moving power and the resistance are naturally compared with other moving powers and resistances to which our minds have been familiar. To the power of a steam-engine there is, in fact, no practical limit, the size of the machine and the strength of the materials excepted. This is compared with agents to whose powers Nature has not only imposed a limit, but a narrow one. The strength of animals is circumscribed, and their power of speed more so. Again, the resistance arising from friction on a road may be diminished by art without any assignable limit, nor does it sustain the least increase to whatever extent the speed of the motion may be augmented; on the contrary, the motion of a vessel through a canal has to encounter a resistance by increase of speed, which soon attains an amount which would defy even the force of steam itself, were it applicable, to overcome it with any useful effect.

As there is some analogy between the opening of the Atlantic steam-navigation and the future we anticipate for aerostation, I will here give extracts from an article in the 'Quarterly Review' of October, 1838, which is an adieu to the American "Liners," and a prospective view of the benefits that would arise from steam-navigation:—

The effect of this achievement is by no means easily to be described or foreseen. Even the Americans, with all their reputation as a self-possessed and considering people, have displayed unwonted raptures and antics on occasion of the first arrival of the "Sirius" and "Great Western" at New York—quite as much so as our Bristol neighbours on their return; and we are not sure that either party is to be blamed for it. We are not sure that the former are far out of their "reckoning" when they speak of this as a new epoch in the history of the world. We can enter into the feeling of the myriads who crowded the wharfs at New York when the English boats were hourly expected—when, finally, after days of almost breathless watching (which, to fearful spirits, might well have afforded some pretext for disbelieving the new scheme—some excuse for casting even ridicule on it after all), at length, on the morning of St. George's Day, the doubts, the fears, the scorn, were alike destined to be removed for ever from the mind of every living creature (even, we dare say—but let us say it with due deference—from that of Dr. Lardner himself): for now appears a long dim train of distant smoke, in a somewhat unaccustomed direction;—it rises and lowers presently, like a genius in the 'Arabian Nights,' portending something prodigious;—by-and-by, the black prow of a huge steamboat dashes round the point of some green island in that beautiful harbour—

"Against the wind, against the tide,
Steadying with upright keel."

It was worth something to be a passenger in one of these fortunate boats at this moment. We have before us the

journal kept by one of the favoured few on board the "Great Western." From the time of crossing the bar of the harbour, all her "poles" were set aloft, and flags gaily streaming at each,—the foreign ensign at the gaff, and at the fore a combination of the British and American,—and "at 3 P.M. (the narrative continues) we passed the Narrows, opening the bay of New York, sails all furled, and the engines at their topmost speed. The city reposed in the distance—scarcely discernible. As we proceeded, an exciting scene awaited us; coming abreast of Bradlow's Island, we were saluted by the fort with twenty-six guns (the number of the States);—we were taking a festive glass on deck. The health of the British Queen had just been proposed—the toast drunk—and, amid the cheers that followed, the arm was just raised to consummate the naming, when the fort opened its fire. The effect was electrical;—down came the colours, and a burst of exultation arose, in the midst of which the President's health was proposed. The city now grew distinct: masts, buildings, spires, trees, streets were discerned;—the wharfs appeared black with myriads of the population hurrying down, at the signal of the telegraph, to every point of view. And then came shoals of boats—the whole harbour covered with them;—and now the new-comer reaches the 'Sirius,' lying at anchor in North River, gay with flowing streamers, and literally crammed with spectators—her decks, paddle-boxes, rigging, mast-head high. We passed round her; giving and receiving three hearty cheers;—then turned towards the Battery. Here myriads again were collected;—boats crowded round us in countless confusion;—flags were flying, guns firing, and bells ringing. The vast multitude set up a shout—a long, enthusiastic cheer—echoed from point to point, and from boat to boat, till it seemed as though they never would have done."

So much for the first transports: we cannot doubt that time, experience, and reflection will confirm the general estimate of the importance of this achievement, which, we may say, is now barely beginning to be made, and that chiefly in a mere mercantile and immediate view. This view itself, however, it must be allowed—waiving for the present all further projections into futurity—is sufficiently exciting, especially to the Americans, who in many respects have more to gain by the new arrangement than ourselves. The intelligence from the Old World, for example, must of necessity be of more general, various, and lively interest to them, than that of the New World to us. The balance of resources, indeed, is immensely in our favour. Not only does America occupy the western hemisphere by herself, while all the other continents are pitched against her in ours, but on that side civilisation has yet made so little progress, things are so literally *new*, that the "United States of America" might with some plausibility assume to be "America" at large, according to the complimentary phraseology usual amongst us. The feeling with which we (unless on extraordinary occasions) watch for news from America is exceedingly different from that with which foreign tidings are awaited by the people of the United States, whose situation, nationally, in this respect, may be almost compared with that of an individual exiled—as poor Crusoe says, "out of society's reach." Of the interest *we* have in *them*, indeed, too much can hardly be said. The great effort employed in this steam-achievement itself, and the extraordinary sensation which the issue of it has excited, sufficiently proclaim a just appreciation of the vast commercial importance, at least to us, of the movement in question.

Whether the greater despatch of news now about to be effected by the Atlantic steamboats will essentially modify this state of things, may admit of some debate. Should it be carried very much farther than we at present witness or anticipate, the result is clear enough—*the Americans would become Europeans.* We remember certain ominous hints of Dr. Lardner's on this head. "Philosophy," he says, in his book on the steam-engine, "already directs her finger at sources of inexhaustible power in the phenomena of *electricity and magnetism*, and many causes combine to justify the expectation that we are on the eve of *mechanical discoveries still greater than any which have yet appeared;* and that the steam-engine itself, with the gigantic powers conferred upon it by the immortal Watt, will dwindle into insignificance in comparison with *the hidden powers of nature still to be revealed;* and that the day will come when that machine, which is now extending the blessings of civilisation to the most remote skirts of the globe, will cease to have existence except in the page of history."

This is looking far ahead, especially for one who has disputed till this moment the practicability of what was accomplished twenty years since (as we shall show)—the passage of the Atlantic by steam. But great men have made great mistakes before this; and we are not sure but the learned Doctor may be in this passage making amends for being thus caught napping, by avowing at the same time, as in the paragraph just quoted, how wide awake he can be when occasion requires,—going ahead of the age on one tack as much as he was drifted behind it on the other. At all events, these mysterious predictions *may* be fulfilled. Let us disbelieve nothing. All preceding generations have missed it by disbelieving.

Steam—to say nothing of "electricity or magnetism"—is no respecter of romance. It reduces things to an

appalling regularity. The British and American Steam Company, who have just launched at Blackwall a ship thirty-eight feet longer than any in Her Majesty's navy, with accommodations (as they advertise) for 500 passengers, notify to us, moreover, that next year they mean to have boats like this running on either side the 1st and 16th of every month. This is but one company—one which has not yet moved, we believe;—for we understand the "Sirius" to have been sent out by another, and the "Great Western," it is well known, belongs to Bristol. Both these, undoubtedly, intend to keep the field, and to meet all competition with spirit. Bristol is said to have already invested a million sterling, and there can be no doubt that the renowned old city of Cabot, though dozing a little of late years over a sort of aldermanic repletion, yet possesses the means, and we dare say the spirit, which more than four centuries since sent out merchant-ships of the burthen of 900 tons. Glasgow, too, will no doubt bestir herself. And, above all, we must leave room for Liverpool: the sole marvel is that Liverpool has waited so long—a secret only to be explained by the extent of the interest there invested in the American "Liners." We see that a company is now started at that port, who announce immediate operations. At New York again—where the same remark just made of Liverpool applies—even during the short stay of the first steamboats, a scheme was started of a joint-stock of a million and a half of dollars, in which, by the way, it was stated the Bristol Company (with a liberal view to the interest of that port) would participate to the extent of about one-sixth.

We were speaking, however, of the first sensation the achievement has produced, and which, we venture to predict, will, at some future day, be a matter of no little historical curiosity. The New York editors seem scarcely able to contain themselves. "Side by side at last with the Old World," says one. "Now then for the Coronation," cry half-a-dozen more. And then the files of European Journals unrolled! Fifteen days from Bristol—sixteen from London—eighteen from Paris—less than a month from Constantinople—from Bombay itself only between sixty and seventy days! A Norfolk (Virginia) editor remarks that *they* are now as near England as they were the greater part of last winter to Detroit; and a Bostonian, we suppose, might say much the same as to New Orleans. A revolution this, indeed, such as the world rarely sees even in our changeful age;—a revolution thoroughly overturning the old systems of most of the business world at least—yet effected, as it were, instantaneously, and without the loss of a drop of blood. The Americans themselves, not more in the transports of their exultation over the first thought of the effects of it, than in their admiration of the thing itself and of the style in which it was carried through, seem to have been too much otherwise excited to feel their wonted chagrin at appearing to be ever taken by surprise in matters of practical adventure. Nay, cherishing, we do believe, the honour of their fatherland next to that of their own (for we have often noticed that, although Jonathan gives us a gruff, grumbling, family growl of a lecture now and then—partly, perhaps, to prove himself our descendant—he is never easy in seeing it done by *anybody else*), they "quite forget their sorrow in their pride." No wonder they have done so; no wonder that a hundred thousand New Yorkers turned out on the 7th of May to behold the departure of the "Great Western" on her first voyage homeward, and to cheer the brave ship on her way; no wonder, again, that when, at the end of a fortnight, she hoisted the British colours in King's Road, the burghers of old Bristol, roused at length from their Rip Van Winkle nap of half a century, broke out with firing cannons, and raising flags, and bell-ringing, and vehement eating of turtle!

Here, at length was an "electric effect" in England—a sensation number two, at the least. One of the passengers in this ship brought over a splendid bouquet of American flowers, which he was able to present to the lady of Mr. Manager Claxton—it seems almost as fresh as if the dew were still on the leaves; and again at the jubilant dinner of the burghers on the 24th, specimens of flax and cotton yarn were exhibited, manufactured in *the new Bristol factory* (a sign of the times that too), which had only been shipped in the raw state, in America, on the seventeenth or eighteenth day before. Some one has predicted that, presently, we shall have Covent Garden market stocked by the other continent. As to the floral department, there may be something in it, for aught we know, and indeed in some others too; for if the "Liners" could bring *the Duke* a present of fresh forest venison from his western admirers, we certainly get a clear vision here of divers good things yet to come. We say nothing, however, even of Yankee ice, dropped at sunrise, in dog-days, upon every door-step in London as in Boston—not one word; *nil admirari*, we repeat, is our motto; "keep cool," that is—ice or no ice—dog-days and all.

But, transports and jesting aside, let us summarily consider a few of the more obvious consequences of some moment which may be expected to spring immediately from the achievement of which we have spoken: to some of them we have already made a hasty allusion.

The improvement of the instrument itself by which this work has been done may be counted on, perhaps, as the first. Without being over-sanguine on the subject, it is reasonable to bear in mind that, while sailing-vessels

have been in existence and been more or less making progress as specimens of art, during thousands of years, we are still in the infancy of steam-navigation. It is only thirty years since Fulton ascended the Hudson with his boat. In 1810 there was no such thing in all England; and so late as 1820 there were but thirty-five. The most important improvements also have been *very* recently introduced; and, without particularising these, it is sufficient to say that the learned Dr. Dionysius Lardner's miscalculations on this subject of Atlantic navigation have evidently been caused by almost wholly overlooking these same improvements even so far as some past years are concerned (and a year in such a progress as this agent is making is not a matter to be overlooked), or regarding them too much as mere speculations, not likely, or not yet fully proved, to be capable of great practical effects (as they have already been); while, as relates to what may yet be established, though now it is but experimental, or what may be discovered, of which now nobody dreams, the calculations in question have apparently left no leeway for the ingenuity of our successors, or even our contemporaries. It was taken for granted that all had been done which could be done —that there were not even any "*hidden powers*" hereafter to be brought to bear upon steam-navigation, as well as upon other things, and to supersede steam itself altogether. How grand a mistake this was we need not say; let us beware of its being made again. Indeed, there is little danger of it, since scarcely a week now passes without the appearance of some new scheme. We have a case in point before us as we write, in the account given by the daily papers of a model-boat, lately constructed on the plan of doing away with the use of paddle-boxes—a most cumbrous, clumsy, and uncouth appendage to the vessel, as everybody knows—by what is called a patent propeller.

Hall's condensers, again, will have a fair trial on the route. It is well known that he claims with these to increase the speed of a boat one-fifth, at least, beyond its capacity with common machinery; and we see that a quicksilver boat, on the plan of Mr. Howard, is going out to America from Liverpool for a trial. We do not say what faith we have in these schemes, or many others that might be named: we mention them as illustrations of the restless, contriving, venturing spirit of the times, especially in this almost new department of action, excitement, keen competition, and high hope. It cannot be doubted, we think, that the passage of the Atlantic by steam will, even in the coming ten years, be brought to a state of (so to speak) artistical luxury and perfection of which those who have started the enterprise themselves little think. The characteristic spirit of the two great nations chiefly interested is now fairly roused to a generous emulation, as it never was roused before; and all that science, skill, enterprise, patriotism, genius, or a love of money, or a love of distinction, can accomplish in such communities, on a subject-matter offering almost unparalleled temptation and stimulus to them all, we shall now be sure to have.

The extension of steam-navigation to other new, vast, and most important regions of the globe, where it has been hitherto unknown, with corresponding influences wherever it is introduced, is a sequel, and an early one, to the present and fast-coming state of things on the Atlantic; as much so as is the continued improvement of this medium of transportation—the one follows, as of course, from the other. Steam-navigation will be extended *because* it will be improved: it will be hereafter, in other words, as it has been heretofore. Ten years ago, or five years, or two, the notion of navigating the Atlantic by steam, as a permanent, practical, profitable thing—as a trade, we mean—had never entered the public mind, if it had that of individuals. And there was good reason for it: Fulton's boat would have cut but a sorry figure steering for Bristol instead of Albany; and some of the much more modern, but now quite obsolete craft, employed within four years by the Admiralty, and upon whose performances demonstrations of the impracticability of the Atlantic scheme have been more or less based—these craft might have fared little better than Fulton's had they rashly attempted what, by better vessels, has now been attained.

Indeed, setting aside improvements, supposing us to stop short where we now are—just ready to begin, that is—nothing could prevent the extension of the plan, as it stands all over the waters of the globe, to an indefinite and now almost incredible extent. It requires no gift of prophecy to see that such, speedily, will be one of the effects of the grand point gained within the last three months. The mere announcement of that scheme was sufficient almost for this. From the date of that announcement, and of the excitement, discussion, speculation, and ambition which it awakened, it mattered comparatively little to the world at large whether the Atlantic project itself was executed at once or not. The *movement*, at all events, was begun. The grand idea of the *revolution* had entered into the public mind and taken deep hold of it, and created a thirst for execution which nothing but execution could satisfy, or can. As matters have turned out, undoubtedly, the public conception and determination are immensely confirmed. The idlest reader of even the daily journals cannot fail to see this. The community teems with projects for the extension of steam commerce and trade in all directions. Some of these must be crude and shallow, for various reasons: such is the necessary fruit of a sudden excitement. But the excitement will soon subside, while the inducement and the

opportunities will remain, and become daily more and more urgent and distinct. This revolution is one of all others that "cannot go backwards." It must advance with an energy, kindred, in the moral world, to that of the physical power itself on which it is founded—an energy to which history affords no parallel. It is scarcely too much, we believe, to say that the whole race of man is destined to see and feel the phenomena and the influence of its all-conquering progress from clime to clime.

So much for the improvement and extension of this instrumentality itself. And now, what of its use?—to what purposes will it be available?—what changes will it work in existing arrangements other than its own? Here we come to questions of some "pith and moment." We cannot go into them in an article like this with any pretence of an adequate discussion, even could it be expected to be in the power or the expectation of any party, in the present stage of such an enterprise, to do justice to the theme. Let us glance, however, at a few points, rather in the way of illustrating the impracticability of the subject than of fairly discussing it.

As regards, then, what may be called the mere mercantile interests concerned—and chiefly the immediate (not prospective) ones—between the two countries, particularly, which seem to have taken up the enterprise in good earnest. These, of course, will experience in this, as in every department, its first and greatest effects. To a vast extent steam-vessels will take the place of sailing-vessels, and that at once. This is not a case, be it understood, in which most people can do as they please. A gentleman, taking a honey-moon excursion with his bride, may possibly prefer some other conveyance to a stage-coach, or even a railroad, and he may even be allowed to humour himself in his fancy; but not so the merchant, his agents, his letters, or many of his goods. What one does must be done by all. The whole of the mercantile world (with scarcely noticeable exceptions) will from this moment adopt the new conveyance, so far as accommodation is provided for them; their entire correspondence must go the same way. The "Great Western," on her first trip, has brought home twenty thousand letters—perhaps three times as many as any sailing-packet on the same route ever carried.

The reason of this transfer in each case is too obvious for explanation; but it may not be known to all our readers to what a degree the uncertainty as well as the length of a sailing-voyage to New York, as compared with a *steamed* one, is an argument for this new arrangement, and a proof of the necessity of its universal adoption. From the very high and well-deserved reputation of the "Liners"—the most perfect conveyance of the kind and the greatest advance in merchant navigation ever known up to the spring of 1838—it is perhaps a common impression, that a passage between France or England and the United States in one of these superb vessels might be counted on as much for a tolerably well-settled period of time, as for the comforts and luxuries to be enjoyed in the course of it, or for the nautical management. The fact is entirely otherwise, as every man in the business well knows. Some seasons are more unfavourable in this respect than others; and the winter months are none of the best, we allow. Neither is the return-voyage so uncertain or so long, we should remark, as the voyage out: it is notorious that the "Liners" have always had smaller fare coming than going, in about the proportion of twenty-eight guineas to thirty-five, and that even the steamboats (without so much reason for it) have thus far continued the custom. But to take a case at hand: during the last winter—at the very time when we were continually getting "late" American intelligence by unusually short and quite regular passages—the corresponding packets going westward were encountering the full face of the same winds and currents by which those coming eastward were propelled. All the "Liners" which left the three European packet-ports during six weeks were baffled and beat about in such a manner, that at one time about eighteen of them were due at New York; and thirty out of fifty belonging to that port were then supposed to be on the ocean, working their way home. The average length of this passage is about thirty-two days. One of the Liverpool ships, which sailed January 4, was spoken, fifty-five days out, in long. 43°—some 1000 miles from her destination; the others were fifty, sixty, or even seventy days on the voyage. That this is no fault of the packets, we need not say; in fact, how they make headway at all is the wonder. Consider, for instance, this paragraph, which we take from a New York journal of the period referred to:—

"We have been shown a chart on which the track of the 'Cambridge' was pricked off, coming from Liverpool, and it is a matter of some astonishment how the ship has reached port at all. She sailed from Liverpool on the 16th January, and on the 29th was in the longitude of 38°. From that day till the 27th February she encountered continued westerly winds, sometimes blowing a severe gale; and for the last seventeen days she made but about 500 miles of westing. During that time she crossed the Gulf-stream three times, was for sixteen days to the southward and eastward of Sable Island, and a part of the time could make no better than a S.S.E. course. The distance between Liverpool and this port is about 3080 miles, but the 'Cambridge' has, on this passage, sailed upwards of

5000. She has proved one of the stanchest vessels which ever breasted the ocean wave. A copy of the track (which looks very much like a spider's web) may be seen," &c.

Few sailing-ships, if any, we presume, would have done so well under these circumstances as a "Liner." We observed, about this very period, in the ship-lists, that a vessel from Demerara, bound for *Halifax*, was blown into *Liverpool* (March 20th), *having been driven out of her course the entire breadth of the Atlantic Ocean!* It is very seldom we hear of a "Liner" returning into port without making her voyage, but with other vessels it is of common occurrence on this route. Ships are out sometimes six weeks, and even more, trying to make headway westward, and obliged to come back and begin again after all. It is not many years since a Belfast craft, bound for New Brunswick, returned to port, at the end of two months' voyage, after having got within 100 miles of her destination!

Here, again, is a striking illustration from one of our provincial journals, referring to the last winter:—

"We cannot more clearly show the uncertainty of passages across the Atlantic than by stating that the 'Inconstant' frigate left Cork on the 6th January, and returned to Plymouth on the 24th February, having been to Halifax in that time—forty-nine days; at the same period the 'Samson,' New York packet, which left Portsmouth on the 5th January, was sixty-two days getting to New York; and the 'President,' which left on the 12th January, was fifty-seven days in reaching that capital; some days, therefore, must elapse before we may expect the return of the 'Pique' frigate, which left Cork on the 23rd January, as she may have been upwards of sixty days making her outward passage, and may also be detained by severe weather in Halifax harbour."

Some readers, little versed in currents of wind or water, and other contingencies incidental to the navigation of this route—some of them quite peculiar to it—might be ready to infer from this statement the reverse of what we have just said. But much more striking cases of the same kind have often occurred; as, for example, where the difference between two packets of leaving the *same* port in the evening of one day, or the morning of the next one, has caused quite as great a diversity as any mentioned above in the length of the voyage. Two ships may even sail at the same moment from New York, and one shall presently—in the Gulf-stream or elsewhere—fall into some flaw of wind or straggling current, the effect of which shall be that the far better sailer of the two reaches Liverpool a week in the rear of her rival. We do not say this is usual, but that there is such a liability. As for the general uncertainty of the length of the voyage, that is notorious.

In the ordinary passenger-ships (commonly called "transient" vessels) as well as other merchant-craft, going westward particularly, while now and then a fortunate one may beat even the "Liners" (as has been done this season), passages of even distressing length may occur, far beyond anything of the sort which has ever happened to *them*. In February, 1837, the British ship "Diamond" arrived at New York from Liverpool, having been *one hundred days from port to port*. There were one hundred and eighty passengers, of whom seventeen died, not from any disorder, but from mere starvation. The principal suffering was among the steerage passengers, the crew having been put upon allowance and supplied to the last with food, though in small quantities. The description of the appearance of these poor wretches on their arrival, given by an eyewitness, is heartrending—our informant himself had lived nine days on potato-peelings soaked in his scanty allowance of water. For any ordinary voyage the supplies in this case were abundant. Some, who had extra quantities, sold out, it seems, "to their less provident fellow-passengers, first at moderate rates, but, as the scarcity more fully developed itself, at enhanced prices, until finally half a sovereign was asked for a pint of meal. Before the arrival of the vessel a sovereign has been offered and refused for a potato, as it was roasting before the fire."

Once more: the bark "Ellen," from Leghorn, with a cargo valued at a hundred thousand dollars, after a perilous voyage of one hundred and three days—her crew having subsisted for fifteen days on maccaroni and sweet oil—arrived within three or four miles of Sandy Hook on the 1st of January last, and hoisted signals. "After waiting four hours, in five fathoms water, and finding no pilot, she was obliged to stand off to sea; and in consequence of the storm which came on, with the disabled state of the crew, she was the sport of the winds, in the severe state of the weather, without fuel, and short of provisions, *for an entire month!*" Such is the general uncertainty together with the contingent hardships, which belong to the old mode of navigating the Atlantic. Nor have we alluded to a tithe of them: this last account, for instance, shows plainly the delay and damage which may follow from the failure of pilotage at a particular place or time; which failure, for various reasons, must happen sometimes with these vessels, though it scarcely ever could, or would be of much moment if it did, if steam were used. Before coming to pilotage, too, it often occurs, even with the "Liners," that great difficulty is experienced in making port, owing to the necessity perhaps of changing directions in order to get in, or to a sudden shift of wind, or a *calm*, forsooth!

Packets have arrived off Cape Clear from New York in ten or twelve days, and then been nearly or quite as much more in making Liverpool—and the same as to Havre—all this time, to say nothing of the delectable situation of the passengers as far as comfort goes, the whole floating correspondence of the two great commercial communities concerned—it may be at a period of most critical importance—bobbing up and down, and off and on, almost within sight of the shore. It reminds us of a remark made the other day, at the opening of the Great Western Railroad to Maidenhead: a gentleman present said that within twenty years he remembered *waiting for twenty-two mails at one time from Holyhead, a distance of some sixty miles from his own town!* The unfortunate breaking-up of the great American merchants in London, last year, was immediately brought on by delays of packets, by which large remittances had been made to them, and which were hourly looked for during the prevalence of extraordinary *east* winds for something like two months. It seems really incredible, indeed, looking back now on what has been suffered in this way, that the remedy for it should have been so long postponed. That the remedy will be heartily used, now that we have it, no man in his senses can doubt.

How far this must be done at once between ourselves and the Americans, we have shown in some detail. Almost all mercantile travel and correspondence must be transferred at once. All light, rich, and seasonable merchandise must speedily go in the same way: it will never do for one man's silks, as the fashionable season comes on, to be sixty days on the voyage, while his neighbour's are fourteen; neither will it do to buy long in anticipation of the market. As to travel and business *not* mercantile, these, like the heavy articles of commerce, will linger, more or less, for some time, with the "Liners" and other sailing-craft. Some people, on sea as well as land, are shy of your newfangled steam things to this day, and would rather stick by even a two-horse coach, a French diligence, a Mississippi ark, or a Newcastle coal-sloop, than trust themselves to the tender mercies of this second "infernal machine" in any of its shapes, especially for the awful distance of three thousand miles. We respect the caution of this class, but they will gradually disappear, and so will those who profess to prefer a *longer* passage, and abhor doing things in a hurry, as much as if they were on half-pay. In fact, there will remain, speedily, no opportunity for the indulgence of these fears, whims, or tastes. We shall have to do, like the merchants, what everybody else does.

To be sure, *accidents* will occur!—more or less these are to be expected, as things are at present. By-and-by we trust—among our "improvements"—this liability will be very essentially lessened; meanwhile, however, we anticipate some trouble. The competition will soon be of the keenest description; the race-ground is most luxurious; the prize tempting; and even passengers themselves too often enter so much into these feelings as to become greatly chargeable with the blame which is commonly laid on others. We confess we are alluding to the case of the Americans rather than to our own; and we hesitate the less to acknowledge it as we consider that their own interest, even more than ours, in the steam-navigation of the Atlantic, is likely to be affected by what we must take leave to call the abominable and disgraceful recklessness in the management of this kind of vessels, which prevails to such an appalling extent among them. We are aware that it is *not* a universal, a national trait, as some late writers have asserted broadly. The New England and New York boats rarely meet with an accident, though they adopt the high-pressure system like the others, and run at the greatest rate of speed which is known; neither is the community at large either of the South or West directly blamable.

The horrid disasters we hear of every few months or oftener—peculiar to the United States, and to this part of them in their awful extent, and by which it is estimated at least *a thousand lives a year* are lost—these are almost always caused immediately by gross misconduct on the part of a few persons in authority, who, for the sake of a race with a rival, or with some other pretext equally cogent, run the most imminent hazards without the slightest hesitation. We have seen accounts of these races on the Western rivers for a distance of a *hundred miles* or more—much of the time neck and neck—the whole ship's company on either side meanwhile desperately engaged, and wrought up to the highest pitch of excitement in the murderous struggle. In this way the "Ben Shersod" got a-fire on the Mississippi, two years ago, when hundreds of passengers perished; and such is the secret of most of the "*accidents*" which, in nine cases out of ten, are no accidents at all, but ought to be criminally visited by the law of the land as much as murder in any *retail* shape. We have heard an American friend of ours allege that no countryman of his would hesitate running the risk of his life for the sake of getting—*anywhere*—half an hour before—*anybody else*. Matthews, we remember, made it apparent, in his way, that the Yankees do everything in "*twenty minutes*." These are caricatures of course—the one no more than the other; but both, we fear, are too well based on fact. The Americans carry their energy a little too far; they retain too much still of the wild impetuosity of youth; they want a new infusion of old John's steady and regular blood. We like not such driving fashions—such helter-skelter haste, in steamboats especially—on Atlantic voyages least of all. Congress we see has the matter in hand, and we trust it will be with

effect: and meanwhile—as even legislation (especially in that country) will not do everything without public opinion—as the managers and masters of steamboats, who have very often been set on, and always tolerated, may also be awed by that public to whom they owe their character and their bread—we earnestly hope that the general voice may make itself heard, and trust that arrangements of the most solid and effective nature may be promptly adopted.

Thus much for a plain hint, which, we are sure, must be taken in good part; for, when we hear, by a single arrival, of one hundred and seventy human beings destroyed in one boat, and one hundred and twenty in another, it is high time for all parties who have to do and deal with such a catastrophe-working community, and are likely to have much *more*, to speak out. And yet, we were going on to say, when this hint occurred to us, that, accidents or no accidents, nothing apparently can stand in the way of the complete triumph of the new dynasty of the seas. Even granting—which God forbid!—that these disasters are to be regularly continued on board the boats from the one side—just as regularly as if, like friction in machinery, they were an indispensable incident to the navigation—still, we English *can* patronise British boats which *do not* blow up three hundred people every three months, while the Americans, on the other hand, can, if they so choose, go on being blown up just as before. If they have more accidents, so they have less fear. "Practice makes perfect." "There is nothing like taking things coolly"—even hot water, or steam. And, as this is their system at home, so may it be abroad. As they are the great steaming people of the age, surely this trifle of merely crossing three thousand miles over sea, instead of running about as far up a river, will never alarm them.*

Of course, those magnificent "Liners," of which we have spoken respectfully so often (for we know them well), will speedily "fall from their high estate." Thinking of the proud part they have played now for some twenty years—of the great reputation they had fairly gained—of the eminent commercial services they have rendered during far the most important period of our connexion with the United States—we cannot see them thus made, as it were, instantaneously obsolete, without almost such a sensation of regret as might be due to living creatures—old, faithful, sensitive servants—dishonoured, mortified, and basely set aside! We have in mind now sundry dry paragraphs of a line and a half, which have appeared in the daily papers of late, much like this:—

"Two packets, the 'North American' and 'Siddons,' have arrived at Liverpool, bringing *old dates* from New York!"

Presently they will cease to be named at all. And look at the "Great Western," the inhuman monster, on her first three days out, *overhauling* a brave old "Liner"—*seven* days from Liverpool—with the black ball, "the badge of all her tribe," in her fore-topsail, under top-gallant sails, careering and plunging to a lively foam and a fair wind. But all would not do as once it might have done. We quote again from the 'Passenger's Journal':—"This new-comer is none of your old sort. See how she comes vapouring up, flapping her huge wheels like an eagle's wings, and snorting, as it were, with the thought of victory and the sight of game. She comes on apace. All her colours are strung out. The ship is almost caught, but she leaps ahead and escapes once more. The steamer, with a dignified air of conscious supremacy, disdaining pursuit, wheels round windward, and passes the 'Liner' on the other side, with 'three hearty cheers.' Then dashing ahead, as if satisfied, she hauls in her *toggery*, and presses her helm hard a-starboard, and the 'Liner'—the brave old 'Liner'—is no more seen. Her owners will scarcely know her when she reaches port at last. She brings no news. She will soon bear no letters—no specie. Nobody will watch for her, nor speak of her. Alas! her day is gone by. Who can think of her sufferings without a sigh?"

But the steamers will have not merely all that is worth having (to them) of the business of the "Liners;" their effect on the *amount* of business must be considered. On this point our notions, at present, must be vague; but it is easy to foretell that the usual operation of increased facilities in the locomotion of persons and the transactions of trade will be felt in this case, and that most remarkably. We have seen that a few millions of passengers yearly go up or down the Thames, since steamboats have plied on it: the travelling by the first boat established between Edinburgh and London was greater, it is said, than that by all other conveyances together, during even the first year. Mr. Porter states that it has almost invariably happened, where railroads for passengers have been opened, that "*the amount of travelling between the extremities of the line has been quadrupled.*" The income from this source has enabled the Liverpool and Manchester Company to meet many extraordinary expenses and still regularly divide 10 per cent. on the capital, although the cost of construction was more than double the sum first allowed for it. So

* A steamboat ascended the Mississippi and Ohio a few weeks since,—sixteen hundred or seventeen hundred miles in six days and seventeen hours,—as we learn from a gentleman then on the spot.

we believe it will be, and much more, between America and Europe. We shall associate with each other as in neighbouring counties. Our tourists will visit Niagara in swarms, as they now do Loch Lomond. People will travel who never did before: it will be literally easier, and *take less time*, as some one has said, to travel than to stay at home.

A word of explanation on one historical point of some interest—which it is well should be settled in season—and we have done. We have alluded to the *fact* that the late passage of the Atlantic by steam was by no means the first achievement of the kind. When we have spoken of the success of these new boats in strong terms, it has not been with the thought of encouraging such an impression; and we certainly do not think it of the least moment, so far as British honour is concerned, that such an impression should prevail. All admit that the mere fact of a solitary steam-vessel crossing the ocean some twenty years ago—whether by steam, or by sails, or both, and with whatever purpose in view—is of little importance as compared with the undertaking and the establishment of such an enterprise, in such a manner as to make it the grand regular medium of communication, and the growing source of immense results, never before dreamed of, between America and Europe. This is the credit claimed in the present instance by British courage, energy, and skill. This the Americans allow us; and they may afford to do it. They have themselves, even in the same field, done enough to content ambition. They have taken up this scheme, in its present stage, with their usual spirit, and without a moment's hesitation or delay. Unseasonable circumstances in their pecuniary situation, more perhaps than anything else, may have prevented them from snatching this last honour from British hands. The conception itself was no new, crude, chimerical notion to them.

They have been too much accustomed to steam-movements on a grand scale to be taken by surprise with this. Not only did Fitch, of Philadelphia, half a century ago, *predict*, with perfect confidence, the establishment of Atlantic steam-navigation, but performances of substantially much the same character, as regards risk, have for many years been actually going on before the eyes of the American public (as, indeed, to some extent also of ours). A few months since we noticed this paragraph in a New York journal:—

"The British steamer 'Sir Lionel Smith,' for which so much anxiety has been felt, reached this port yesterday, *in fifteen days from St. Thomas.*"

Along the extensive coasts and up the vast rivers of the United States the nature of their steam-operations is well known. At New Orleans they were talking, a year or two since (as well as at New York), of establishing this connexion with Europe by steam, and the project seemed to have been abandoned merely on account of the "crisis." A British passage across was made last winter by the "City of Kingston," intended for a Jamaica and Carthagena mail-packet, we think. She, too, was much talked of as the first which had crossed. It seems, however, that she put in at Madeira on her way. It is also well ascertained that three steam-vessels, at least, had crossed—all the way—before her. Two of these were the "Royal William," built at Quebec, for the trade between that port and Halifax, which was sold some years ago to the crown of Portugal for 12,000*l.* (and which we ourselves happened to see in Boston harbour, five or six years ago, when just arrived from Liverpool *vid* Halifax), and the "Cape Breton," which was built at Greenock or Glasgow, and sent out to Pictou for the use of a mining company. But the vessel to which the honour of first crossing, such as it is, must doubtless be awarded, was the "Savannah," thus alluded to in the 'Times' of May 11, 1819:—

"*Great Experiment.*—A new steam-vessel, of 300 tons, has been built at New York, for the express purpose of carrying passengers across the Atlantic. She is to come to Liverpool direct!"

And she did reach Liverpool, accordingly, on the 20th of June—coming, moreover, direct from Savannah in twenty-six days. We have seen it stated that this vessel used her steam only when she failed to make four knots the hour by sailing; but these particulars, as we said before, are hardly worthy of notice. After a somewhat enthusiastic reception at Liverpool, she proceeded to Stockholm, where Bernadotte went on board and made the captain sundry presents, significant of his royal gratification. The Emperor of Russia visited her also at Cronstadt and gave his host a silver tea-kettle, which he retains, as a trophy of his adventure, to this day.

To these, we believe, might be added the "Curaçoa," which is said to have gone over direct from Holland to Surinam, in 1828, making the voyage from off Dover in twenty-four days.

And this, as far as we know, is the whole history of Atlantic steam-navigation. Its history, a hundred years hence, will be more worth telling, though perhaps it may contain nothing more interesting to the men of those times than the early experiments of which we have now finished an humble sketch.

With minds thus prepared let us come to the question of aerial navigation after taking notice of what has been tried. We will present the difficulties in a tabular form, wherein we shall find that they may be all included under eleven heads.

The experiments of Blanchard, of Guyton de Morveau, and other aeronauts, prove that oars can only slightly affect a balloon in a perfect calm. The celebrated Monge, the inventor of descriptive geometry, and Member of the French Academy, in 1783, proposed a method of directing aerostats. As many as twenty-five spherical balloons were to be attached to each other, like beads in a necklace, so that they could either lie in a straight line, or bend in all directions. Two aeronauts might be attached in a car to each, and receive their orders by signals from the captain for ascending and descending. He supposed that in this manner the movement of a serpent in the water would be imitated; but this singular project was never put into execution.

General Meusnier, a distinguished officer of the French Engineers, has given the best calculations that have yet been made towards the progress of aerostation, in a work published in 1785; but his figures were neglected till Mons. Marey Monge embodied them in his able work in 1847.

He proposed a spherical balloon of ordinary dimensions, with an exterior cover, to contain compressed air. By means of a pump he was to fill or empty this, thereby rising or falling without valve or ballast. As to horizontal movements, Meusnier trusted to atmospheric currents, and therefore devised such a plan as would enable the aeronaut to move from one current to the other. It was by means of cross sails like a windmill, which could be contracted and expanded with all the power the aeronauts possessed, and with this he calculated on obtaining a movement of three miles an hour.

The 'Times,' in the spring of 1840, thus chronicles the success of one of Mr. Charles Green's models at the Polytechnic Institution:—

A miniature balloon, of about three feet diameter, was filled with common coal-gas. To this were attached the hoop, netting, and car, and in the car a small piece of spring mechanism was placed, to give motion to the fans. The balloon was then balanced: that is, a sufficient weight was placed in the car to keep it suspended in the air, without the capacity to rise or inclination to sink. Mr. Green then touched a stop in the mechanism, which immediately communicated a rapid rotary motion to the fans, whereupon the machine rose steadily to the ceiling, from which it continued to rebound until the clockwork had run out. Deprived of this assistance, it immediately fell. The reverse of this experiment was then performed. The balloon was first raised into the air, and then balanced. A similar motion was imparted to the fans, the action of which in this case was, however, reversed, and the balloon was immediately pulled down to the ground by their forces. A more interesting effect still was then exhibited. The balloon, with the guide-rope attached to it, was balanced as before, the guide-rope having a small brass weight fixed to the end of it. The fans were then removed from under the car, and placed sideways upon it, by which their action became vertical. Upon motion being communicated, the balloon floated in a horizontal line, dragging the guide-rope after it with the weight trailing along the floor, and continued to do so until the mechanism ceased, when it immediately became stationary again. These experiments were frequently repeated with complete success. Mr. Green states, that by these simple means a voyage across the Atlantic may be performed, in three or four days, as easily as one from Vauxhall Gardens to Nassau.

"The vast number," says M. Depuis Delcourt, "of propositions for guiding balloons may be thus classified:—

"1st. The reaction of heated air on the atmosphere by the means of valves on the sides of a Montgolfière.

"2nd. Chemico-physical agents, and agents purely mechanical, for Charlières.

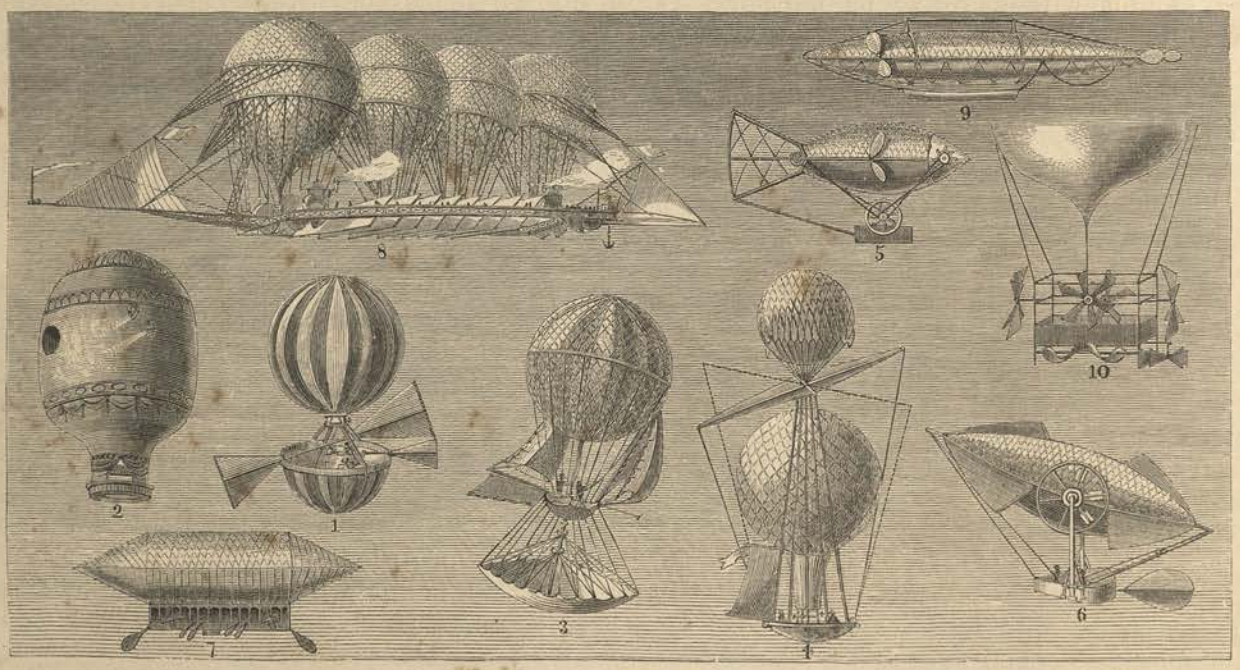
"3rd. By towing-machines,—a method thought of by Thilorier, which is susceptible of receiving in certain instances important and useful application. These different methods may be subdivided into fourteen classes:—

CLASSIFICATION OF THE VARIOUS METHODS PROPOSED FOR THE DIRECTION OF AEROSTATS.

| MONTGOLFIÈRES. | CHARLIÈRES. | |
|---|---|---|
| | Chemico-physical Agents. | Mechanical Agents. |
| 1. Openings for heated air.<br>2. Reaction on the atmosphere. | 3. Compressed air or gas.<br>4. Steam .. { "Eolipyli," or direct jet pumps. } Turning or fixed.<br>5. Gunpowder { Simple fusees. Composite fusees. Cannon. "Mortier à recul." Shells. | 6. Inclined planes.<br>7. Groved surfaces.<br>8. Archimedean screw.<br>9. Sails.<br>10. Reversed parachute.<br>11. Oars.<br>12. Wing-like wheels.<br>13. Blasts of wind. |
| Trained and harnessed birds.<br>Atmospheric currents.<br>14. Towing-machines. | | |

"Some of these will not stand the slightest investigation, and others are repeated with so many modifications that it is difficult to form an opinion of their merits. Patents are frequently taken for nearly the same invention, inventors having neglected to remark what has already been done."

The engravings herewith given will suffice for samples of some of the attempts already made, and need no further explanation.




THE GROUP OF EXPERIMENTS.

No. 1.—A Flying Globe made by an engineer named Blainville. It is not explained how these wings were to be used; but it gives the idea of weighting and lightening a balloon with air by means of a pump.

No. 2.—18 July, 1784, Abbé Molan's Montgolfière. A lateral opening from which it was expected the heated air would rush and force the balloon in the opposite direction. The machine catching fire, the experiment was not made.

No. 3.—A balloon with a reversed parachute by Mr. Henin. This parachute was to slacken the ascent of the balloon, and allow the action of the wind on the sails, thereby guiding it at pleasure.

No. 4.—Sir George Cayley's Navigable Balloon, 1816.

No. 5.—Samson's Aerostat furnished with fins made of feathers; but, like Julien's, a motive power is required.

No. 6.—

No. 7.—The Aerial Ship "l'Aigle," of Mr. Lennox. It proved a failure in the Champs de Mars, August, 1834.

No. 8.—Système Petin, 1850.

No. 9.—Julien's Aerostat. This aerostat, made in a model, 25 feet in length, succeeded in the experiment made at the Hippodrome at Paris, and went against the wind. Its movement was by clockwork suspended below. This invention deserves encouragement.

No. 10.—November, 1851, Aerial scheme of Mr. Helle not yet tried; consisting of a combination of sails and screws moved by the strength of two men.

M. Depuis Delcourt says :—

"*Balloons*, i. e. aerostats of spherical form, *can never be guided*, as it is only possible for them to turn on their own pivots. Their progress is by fits and starts, swaying backwards and forwards.

"A guidable aerostat can be made, but then it should be ship-like, with wood and metal in its construction, involving a serious attempt, for which money is required. The value of one iron-clad, if spent on a proper course of experiments, might have decided the form and construction of a serviceable aerostat, and the stake to be won is far greater than the cost would be."

The most complete aerostat of this description hitherto tried was Henson's Aerial Carriage, which is thus briefly described by Mr. Wise :—

Many persons were sanguine in the belief that his machine was destined to perfect the art of aerial navigation, and it was seriously contemplated to build one after his model, with which to cross the Atlantic. Indeed, it was well calculated to inspire such a belief in the mere theoretical mind; but to the practical man it at once occurs, What is to keep it from tilting over in losing its balance by a flaw of wind, or any other casualty, and thus tumbling to the ground, admitting that it could raise itself up and move forward?

The principal feature of the invention is the very great expanse of its sustaining planes, which are larger, in proportion to the weight it has to carry, than those of many birds; but if they had been still greater, they would not have sufficed of themselves to sustain their own weight, to say nothing of their machinery and cargo; surely, though slowly, they would have come to the ground. The machine advances with its front edge a little raised; the effect of which is to present its under surface to the air over which it is passing, the resistance of which, acting on it like a strong wind on the sails of a windmill, prevents the descent of the machine and its burden. The sustaining of the whole, therefore, depends upon the speed at which it is travelling through the air, and the angle at which its under surface impinges on the air in its front; and this is exactly the principle by which birds are upheld in their flight with but slight motion of their wings, and often with none.

But then this result, after the start, depends entirely on keeping up the speed, and there remains beyond that the still more formidable difficulty of first obtaining that speed. All former attempts of this kind have failed, because no engine existed that was at once light enough and powerful enough to lift even its own weight through the air with the necessary rapidity. Mr. Henson has removed this difficulty partly, by inventing a steam-engine of extreme lightness and efficiency, and partly by another and very singular device, which requires particular notice. The machine, fully prepared for flight, is started from the top of an inclined plane, in descending which it attains a velocity necessary to sustain it in its further progress. That velocity would be gradually destroyed by the resistance of the air to the forward flight; it is, therefore, the office of the steam-engine and the vanes it actuates simply to repair the loss of velocity; it is made, therefore, only of the power and weight necessary for that small effect. Here, we apprehend, is the chief, but not the only merit and originality of Mr. Henson's invention; and to this happy thought we shall probably be indebted for the first successful attempt to traverse at will another domain of nature.

The editor of 'Newton's Journal of Arts and Sciences,' speaks of it thus: "The apparatus consists of a car, containing the goods, passengers, engine, fuel, &c., to which a rectangular frame, made of wood or bamboo-cane, and covered with canvass or oiled silk, is attached. This frame extends on either side of the car, in a similar manner to the outstretched wings of a bird; but, with this difference, that the frame is immovable. Behind the wings are two vertical fan-wheels, furnished with oblique vanes, which are intended to propel the apparatus through the air. These wheels receive motion, through bands and pulleys, from a steam or other engine contained in the car. To an axis at the stern of the car a triangular frame is attached, resembling the tail of a bird, which is also covered with canvass or oiled silk. This may be expanded or contracted at pleasure, and is moved up and down for the purpose of causing the machine to ascend or descend. Beneath the tail is a rudder for directing the course of the machine to the right or to the left; and, to facilitate the steering, a sail is stretched between two masts which rise from the car.

The amount of canvass or oiled silk necessary for buoying up the machine is stated to be equal to one square foot for each half-pound weight, the whole apparatus weighing about 3000 lbs., and the area of surface spread out to support it 4500 square feet in the two wings, and 1505 in the tail, making altogether 6000 square

feet. The engine is proposed to be of from twenty-five to thirty horse-power. It is stated in the specification that, on launching the machine into the air, an elevated situation must be selected, and the machine allowed to run some distance down an inclined plane, for which purpose vertical wheels are attached to the bottom of the car or boat. When the machine has thus acquired a momentum, the rotary fan-wheels are put in motion to raise it into the air and propel it; the rudder appended to the car is then used for regulating its course.

"The photozincograph of this machine represents the aerial steamer flying. The bat-like wing, or sail, is the tail, which turns on joints, answering the same purposes as the tail of a bird, and can be depressed, elevated, contracted, or expanded, at the will of the commander. The car, containing the steam-engine, cargo, conductors, and passengers, in suitable compartments, is represented by windows, and three wheels upon which the carriage can run on land. Aerial goes foremost, and is a little raised: to the middle of the other is jointed the tail. The carriage is two hundred and fifty feet by thirty, and the tail is fifty feet long. The rainbow-like circular wheels are the propellers, answering to the wheels of a steamboat, and acting upon the air after the manner of a windmill. The car is seen at one side, owing to the difficulty of representing it in an engraving *underneath* the surface of the carriage, where it is located, between and below the propelling wheels."

This invention drew the attention and commendation of the scientific both of Europe and America. It certainly comes nearer to the construction and consequent physical action of the bird than any that has ever preceded it. It, moreover, embraces all the most rational conceptions and fine mechanical contrivances, without the inefficient incumbrances, of all other flying machines that have ever been brought before the public. We might go on and multiply the description of plans and models that have been suggested of late years; but as the ones we have here given seem to embrace every valuable discovered feature of mechanism, it seems useless to waste time in their further investigation.

The propulsion of the spheroidal balloon by steam or any other power, applied to the windmill-like paddle-wheel, was first shown by a working model, put in motion by a clock-spring, by Charles Green, of England, one of the most experienced aeronauts in the world, before the Society of Arts of London, ten or twelve years ago. By reference to the London papers of that period a description will be found concerning it.

I here annex an article on the same subject from the 'Westminster Review':—

The problem of aerial navigation is, of course, not completely resolved by the invention of a machine or apparatus capable of sustaining the human body in the air. It is necessary to discover, likewise, the means of guiding or propelling such a machine in any direction. It would, perhaps, at first sight appear probable that, if means of floating in the air be discovered, a method of propulsion could be readily found; yet it has proved in practice a far more difficult attempt than had, at first, been imagined; and the numerous schemes for effecting this object have all proved abortive, or been attended with success so insignificant as not to warrant the further prosecution of them. The balloon invented, the art of guiding or propelling it appears thus to be almost as far from our grasp, and as distant of attainment, as ever.

Since the invention of the gas-balloon by M. Charles, of Paris, but few improvements of importance have been made in it; and, as might be foreseen from the original simplicity of the invention, what improvements have been made are not improvements in the principle, but in minor matters of detail. The most important improvement since introduced is one effected in the early part of the present century by Mr. Green, well known for the many successful public ascents which he has since made. This improvement consists in the use of coal-gas instead of pure hydrogen, which latter gas was employed in the ascents of M. Charles, and the subsequent ones of Lunardi, Garnerin, and other aeronauts.

One of the principal advantages arising from the employment of coal-gas is economy, the saving of expense being very great; at the same time, from the greater density of the gas, its use entails this disadvantage—that the balloon is required to be of somewhat larger dimensions than when pure hydrogen is employed for inflation. The original expense of construction is thus increased, but the disadvantage of the greater cost and size of the balloon is more than counterbalanced by the economy and convenience attending the use of coal-gas; and, what is of great importance, if balloons are eventually to become of practical utility, the period which a balloon retains its ascending power is considerably prolonged, when coal-gas is substituted for pure hydrogen.

Since the introduction of the use of coal-gas in aeronautics, but few, or rather, perhaps, we ought to say, no improvements in the construction of balloons have been made; minor improvements have indeed been made in the

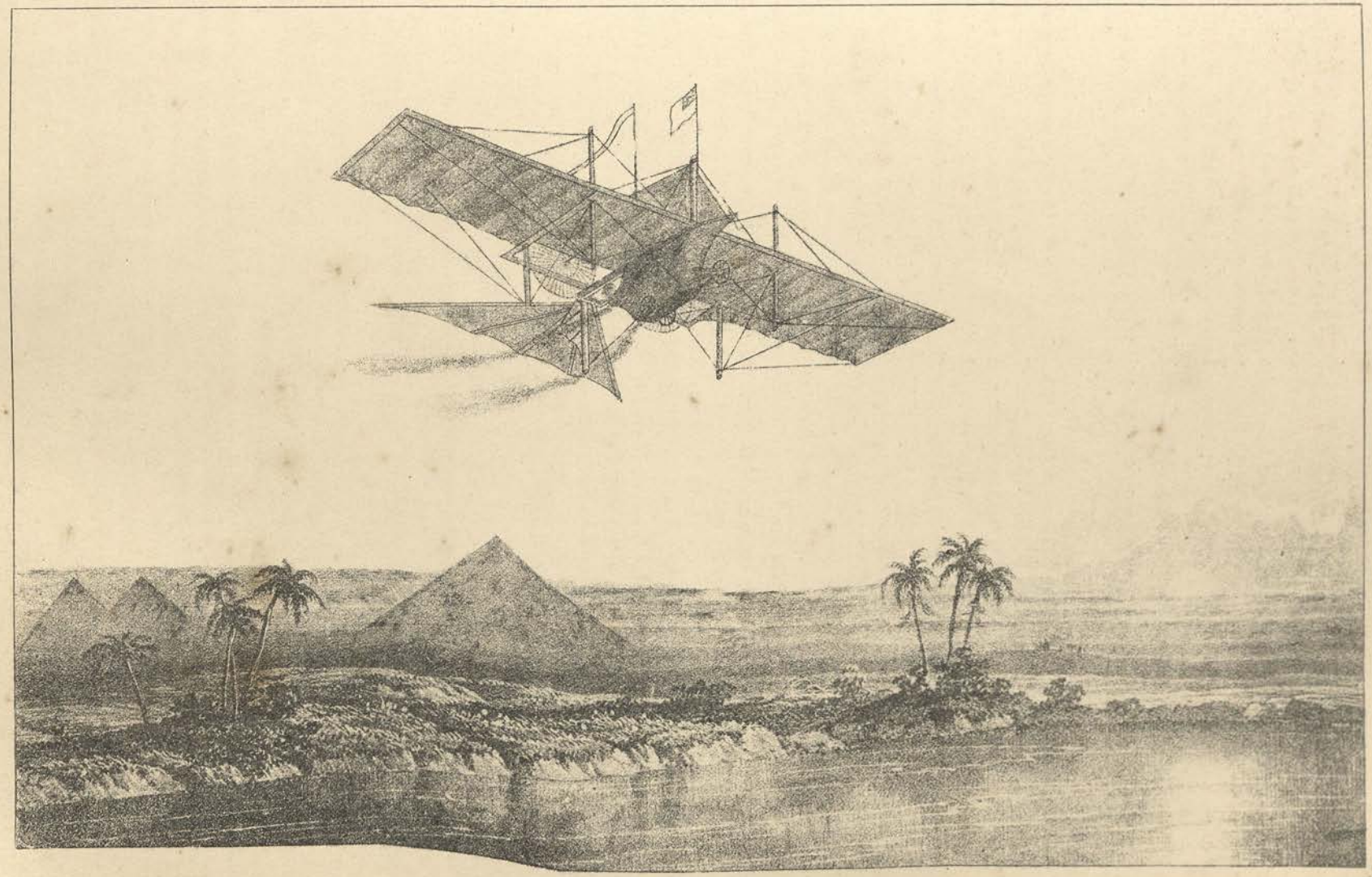


*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Holsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director.*

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form and arrangements of some parts of the machine, or apparatus connected with it, such as the ingenious method of liberating the balloon employed by Mr. Green, whom we have already mentioned; but these are all simple contrivances of detail, which in no respect alter the principle of the machine.

With the invention of the balloon we had then obtained the means of floating in the air, and acquired possession of a contrivance for this purpose; which, except its inability to support very great weights, left but little to be desired, when considered as destined merely to support the human body in the air and to move freely with the wind. But the employment of such a contrivance can scarcely be called aerial navigation, and, in fact, only half the work had been done: the ship for navigating the air had been invented; the art of sailing is still unknown. We can scarcely consider ourselves to have succeeded in discovering the art of aerial navigation until the aeronaut has at his command the means of varying the elevation of the balloon above the earth, and of causing it to move in any horizontal direction at will. Two methods of effecting this naturally suggest themselves; indeed, the art of aerial navigation may be considered (as that of ocean navigation now generally is) as divided into two great and distinct branches: the one, comprising the manner of directing the machine by the agency of the wind itself in any direction, either coincident with or different from that of the wind; the other, the employment of artificial means of propulsion, such as propellers driven by steam-engines, or machinery of a similar nature. Of the attainment of a practically useful method of propelling balloons by the motive power of steam we fear there is little hope; and were the attention of projectors directed to a method of sailing balloons, rather than propelling them, it is probable some useful practical progress might soon be made in the art of aerial navigation. Attempts at guiding balloons have indeed been made, but, being ill directed, have always failed; and, in fact, the application of the steam-engine to locomotion not having been made at the time of the invention of balloons, all the early attempts at guiding balloons or increasing their speed were directed by the analogy, real or supposed, of a balloon and a sailing-vessel.

The supposed identity of the two cases led immediately to the trial of sails and rudders applied to balloons; the experimentalists not perceiving the considerable and important difference existing between the two—a balloon and a ship—appear to have fancied that the two cases differed merely in that of the balloon floating in a medium of far less density than water. The similarity of the two cases is, however, apparent rather than real. In the eagerness of the attempt, it was entirely overlooked that whilst the balloon, entirely surrounded by and immersed in the fluid which supports it, moves necessarily at the same rate as the current of air in which it happens to be, a vessel floating on the surface of the water is impelled by the force of the air, which, moving at a much greater velocity than any current, either in the river or the ocean, has, notwithstanding its much less density, sufficient power to give motion to the vessel. Sails and rudders, then, when applied to balloons, were found useless; the first did not increase the speed of the balloon, the second had no effect in guiding it. Sails were, of course, useless, since there was no wind to fill them—a balloon moving as fast as the wind; and for the same reason, there being no current, the rudder had no action on the direction of the motion.

The more recent attempts made of late years have almost invariably been founded on schemes for propelling balloons; and, in a great number of these, the employment of the steam-engine is a principal feature. The objections to the employment of this motive power, even if it should be found possible to avail ourselves of the force of steam for this purpose, would probably prove of such force as to prevent its introduction to any extent. It may, no doubt, be urged that, in a medium of so small a density as air, the actual force required to propel a balloon would be very small, and that this being the case, the size and weight of the machinery necessary to impel a balloon need not be very considerable; and that, therefore, it would be found possible to construct balloons of sufficient size and ascending power to carry the necessary machine. But, were it even so, the necessity there would be of either relinquishing the use of the propeller after a very short period, or of descending to obtain supplies of fuel and water, would be found to render its practical application of but little value. If it be also remembered that to work a steam-engine it requires not only an engine and boiler, but a heavy weight of water and fuel, even if the engine work but for a very short time, and also engine-men and stokers to work the machinery and feed the fires, the uselessness of the attempt is so evident as to render numerical calculations unnecessary for exposing its fallacy. The lightest form of marine steam-engine in use weighs about thirteen hundredweight per horse-power; and when to this we add the weight of fuel and water contained in the boiler, and that of the men necessary for attending the machinery, we arrive at a sum total for the weight, whatever horse-power we may assume as necessary, entirely beyond the power of any balloon to support. For, though we may imagine a balloon of such vast dimensions as to be able to support such a weight, yet the construction of such a balloon would be difficult, and its inflation almost impossible.

But, hereafter, one means of obtaining motive power may be discovered which will enable us to dispense

with the cumbersome appendage of a steam-boiler, and the weight of fuel and water necessary for it. Electro-magnetism may, perhaps, stand us here in good stead; but, at the present moment, the recently discovered gun-cotton offers, perhaps, the best hopes of success. The enormous force of this substance, compared with its weight and the space it occupies, the abolition of the boiler and all fuel which it will effect, and the fact of no water, either for feed or condensation being required, are advantages which make us look forward to a trial of gun-cotton as offering a prospect of greater success than has hitherto attended attempts at balloon propulsion. Gun-cotton might be tried, probably with some effect, on the recoil principle of the rocket and the fumific impeller of Mr. Gordon, as well as with machinery similar to the ordinary steam-engine, such as has recently been patented by Mr. Talbot. The force of steam not being in this case applicable as a propelling power, if that of gun-cotton should not be found available, we must seek in another direction for a motive power, which, with a small weight, gives an intense force. The great object of the inventor will evidently be to get rid of a heavy incumbrance, such as a steam-boiler, and to confine his machine within the most narrow limits possible as to space and weight. The use of gun-cotton in lieu of steam, would certainly reduce the size and weight of the machinery, as far as we can reasonably hope to reduce it. Our propelling machinery would then, in short, be a steam-engine working without water, without a boiler, and with but a very small weight of fuel; but, until this substance has been successfully applied as a motive power, its application to ballooning must, of course, be mere conjecture.

There can be no doubt that if a motive power fit for the purpose could be found, some form of propeller would soon be invented capable of applying this power, with good effect, in the propulsion of balloons. The numerous experiments which have been made during the last few years with submerged propellers applied to steam-vessels, make it certain that a similar form of propeller might be used for balloons with a fair chance of a successful result, if only a moderate velocity be required. We have ourselves seen a model balloon furnished with a screw-propeller, worked by clockwork, perform in a satisfactory manner in a small room, the air being still. The employment of a propelling power applied to the car of a balloon would, however, experience a difficulty of a peculiar nature, which presents itself in all balloon experiments: this is a constant, though slow, rotation of a balloon round its vertical axis. The use of the guide-rope, which we shall presently describe, almost, if not entirely, destroys the tendency to rotation; but one effect of the guide-rope is to retard the motion of the balloon, while the object of the employment of a propelling force is, of course, to increase the velocity of the balloon, so that the cotemporaneous employment of the propelling force and the guide-rope is scarcely feasible; but until, by some alteration in the form of balloons, or by the application of some mechanical contrivance destined to that effect, the tendency of a balloon to rotate round its vertical axis be destroyed, the application of propelling machinery to balloons can be followed but by little or no useful effect.

The want of success attending the early attempts at guiding balloons appears to have deterred adventurers from repeating these experiments or devising new methods for effecting this object; and, since the beginning of the present century, nothing of practical utility has been tried. However, Mr. C. Green, whom we have already had occasion to mention, has broached an idea which appears to be in the right direction, and which will possibly, when modified, be found to be feasible. Mr. Green having remarked, during his numerous balloon-voyages, that at various heights above the earth he met with currents of air which carried him in a direction different from that in which the wind was blowing at the time of starting, conceived the idea, if it be possible to keep a balloon at a constant elevation above the surface of the earth, that advantage might be taken of this circumstance; for, by increasing or diminishing the altitude of the balloon, a current of air might be found to carry the aeronaut in any direction he might desire. It has, indeed, been long known that the wind, observed at the surface of the earth, does not blow in the same direction with the current of air moving at some distance from the earth. This phenomenon occurs not only in our latitudes, but also in the regions of the trade-winds; and several observers, amongst them Sir James Ross, in his recent voyage, have noticed, when in the trades, small clouds moving at a considerable height above the sea in a direction contrary to that of the trade-winds. It is obvious that if it be true that, at some height or other above the earth, we may find a wind blowing in any given direction, and supposing we can cause the balloon to remain invariably at the same height, we might be enabled to move a balloon in any direction merely by ascending or descending until a current of air having the required direction is met with.

Various methods of causing the balloon to remain at an invariable height may, doubtless, be supposed; but the one actually in use, namely, that of discharging gas or ballast according as it may be necessary to check a tendency of the balloon to rise or fall, is of very limited application, for the quantity of ballast and gas which can be employed in this manner is very small. The power of varying the elevation, or remaining at the same height,

would be greatly extended by the use of condensed or liquefied gas; a small receiver containing liquid coal-gas might be taken up in the car, and, being connected with the balloon by a tube and stopcock, the aeronaut would be able, by the simple opening of the stopcock, to permit the entrance into the balloon of a large quantity of gas. There would undoubtedly be a few practical difficulties in its application, but none such as could not be readily overcome; but the danger attending the use of gas in this form is but slight, liquefied gas having been in common use for some years past for lighting apartments and railway carriages in France.

Mr. Green, however, proposes Mr. Baldwin's method, which is very different from the above. He supposes the aeronaut furnished with a rope of sufficient length to reach from the balloon, when in the desired current of air, to the earth: one portion of the rope resting on and trailing along the surface of the earth or sea, as the case may be, while the other end is attached to the balloon or car. If the balloon, from the effects of the sun's rays on it, rise to a greater elevation, a corresponding length of rope will be raised off the surface of the ground and supported in the air; and in the same way, if the balloon sink, an additional length of rope will be plunged in the water or drag along the earth. The result will be that, in the one case, the same effect will be produced as if an additional quantity of ballast were added to, or a small volume of gas allowed to escape from, the balloon; in the other, the effect will be similar to that of the discharge of ballast from the balloon. It is evident that by this contrivance the balloon will remain at nearly the same height from the ground, the effect of any expansion or contraction of the gas created by increase or decrease of the temperature of the surrounding air being counteracted by the alteration in the weight which the balloon has to support, and that without any loss of either ballast or gas. This method, however, could scarcely be practicable except at sea, on account of the damage and difficulty its employment would occasion by the entanglement of the rope in trees and buildings; but at sea no difficulty arising from these circumstances could be experienced, and the experiment is certainly well worth a trial. At great elevations above the earth the weight of the rope would also become so considerable as to require for its support a large portion of the ascending power of any balloon.

One thing is clear, that the friction of the rope on the earth or in the water would occasion a degree of resistance sufficient to retard in some degree the speed of the balloon; and this would lead us to hope that, this plan being adopted, it would be found possible to guide or steer balloons. We have already observed that, to guide or steer balloons, it will be necessary to find out some method of creating a relative velocity between the balloon and the wind which impels it; or, in other words, we must arrange matters so that the balloon move either slower or more rapidly than the wind. Now this is effected by the proposed guide-rope of Mr. Green; and we may observe that sailors are sometimes compelled to resort to a similar artifice in order to obtain steerage-way on a vessel.

This artifice in navigation is termed 'kedging,' and is employed when vessels are floating down streams or rivers when there is no wind. Under such circumstances, a vessel would be in constant danger of being run on shore, unless steerage-way could be got on the vessel. This is effected in the following manner:—It is well known that an anchor holds the ground more or less firmly, according as its distance from the vessel is greater or less; and, when the anchor is immediately under the ship's bow, it has very little or no hold. Now, supposing a vessel be in a tideway with no sails set, to obtain steerage-way the anchor is allowed to trail along the ground under the bows of the vessel, the cable being hove down until nearly vertical; and the resistance thus opposed to the motion of the vessel through the water is sufficiently great to enable the vessel to be steered. The artifice above briefly described evidently bears a striking resemblance to the guide-rope of Mr. Green, and we think that an attempt at steering balloons, made in conjunction with the use of the guide-rope, would be successful. Of course, some practical difficulties would be found to exist, and the form and arrangement of the steering apparatus would be a subject for great consideration. Some difficulty would also be met with from the rotation of the balloon on its vertical axis.

At sea, where this idea holds out great hopes of success, the lower end of the guide-rope should be attached to a small boat or float, which would increase the resistance and give additional steerage-way.

The difficulties of steering balloons would then be found, we think, to be far from insuperable. The rotation of a balloon about its vertical axis would likewise be found a considerable obstacle to the use of any propelling power, since the rotary motion of the balloon would cause the direction of the propelling force to change at each instant. A balloon always rotates in this manner; but its rotation is slow, and the fact is not at once perceptible, and only apparent on regarding fixedly an object—such as a cloud—at some distance from the spectator,

* Mr. Coxwell considers the use of the guide-rope on the earth highly objectionable and dangerous, unless it be used at the moment of descent, when it offers many advantages. On the water it would prove invaluable.

when the position of the observer is soon found to change. It is possible that, were a form other than the spherical one usually adopted given to a balloon, this motion of rotation might be very much diminished, if not altogether avoided.

## The Fulcrum.

Meusnier* has treated this question in a masterly manner; and in one of his essays has analysed the *point d'appui* in the air. Ignorance of this principle has caused many mistakes. He easily shows how little permanent equilibrium there can be in the atmosphere for a silken globe, which in respect to it is no more than a soap-bubble. It is otherwise with aerostatic machines, solid, strongly built, and possessing a power of resistance and motion.

A *point d'appui* does exist in the air; the bird has no other for rising and maintaining itself in the atmosphere. The descent of a parachute is checked, because it finds in the air the force of resistance, which is the true *point d'appui*. The fish floats like an aerostat, by its specific lightness. Though the rivers and seas have their currents, yet the fish, by its form and locomotive powers, can overcome them; and it has been taken as a model in the machines of Scott, Pauly of Geneva, and Mr. Egg, &c.

Mr. Monck Mason, the able and zealous writer, whose description of the balloon-voyage from London to Weilburg we have already quoted, printed in an appendix to that account the following "Observations," which have formed the basis of the articles on aerostation in several of our encyclopædias.

Steam-navigation has already shown us that the figures of scientific men are not always to be depended upon; and in this instance their errors have been so clearly demonstrated by M. Marey Monge (a nephew of the inventor of descriptive geometry), in a work published in Paris, in 1847, "that all who run may read" that the practicability of aerial navigation is now demonstrated by mathematics.

### Observations upon the Mechanical Direction of the Balloon.

To display in its proper colours the long-contested question of aerial navigation, and enable the general reader to form an opinion for himself as to the probability or improbability of the accomplishment of that most interesting, and indeed important of all mechanical desiderata, is the object we have proposed to ourselves in the following investigation. In the execution of this design we have felt it necessary to abandon the attractive but irregular paths of description for the more tame and tedious avenues of systematic reasoning. But the truth is, the inquiry itself properly admits of no other mode of treatment. The case of a balloon artificially propelled through the air, is one essentially involving the elements of the pneumatical and mechanical sciences, and can only be satisfactorily argued as to its practicability, upon the basis of strict mathematical induction. Any attempt to dispose of it without these aids, however it may serve to amuse, must notoriously fail in the only object for which its services are required; namely, to determine the expectations of the curious, and direct the efforts of such among them as may yet feel inclined to indulge in the attempt to accomplish it.

The recondite nature of the principles upon which it is based does not, however, by any means involve the

* General Meusnier was a distinguished officer of Engineers, a member of the Academy of Paris, and author of many works. He had spent ten years at Cherbourg in the study of Aerostation, when in 1793 the war called him to the Rhine, and he was killed by a bullet at the siege of Mayence. At his death "Les Prussiens saisis d'admiration et de respect, cessèrent leur feu, pour donner aux Français le temps d'élever la tombe de leur général dans un des bastions de la ville. 'Je perds un ennemi qui m'a fait bien du mal,' s'écria Frédéric-Guillaume; 'mais la France perd un grand homme.'" (M. de Lamartine 'Histoire des Girondins.') His papers remained at Cherbourg till Monge collected and forwarded them to the Minister of War. They were afterwards sent from Paris to the school of Metz, where they may still be seen. A portfolio of designs, an explanatory pamphlet, and the Memoir read at the Academy of Sciences in 1783, are the only important works of his on aeronautics now existing. Among the designs is the outline with minute measurements of a magnificent ellipsoidal aerostat, the longer axis being 87 mètres, and the shorter 43 mètres. It was designed to carry thirty men, with provisions for sixty days.

M. Marey Monge in his 'Études sur l'Aerostation' thought that he could not aid the Science of Aerostation better than by publishing these designs.

necessity for a like abstruseness in the conduct of the inquiry they are designed to support; nor, indeed, would such a conclusion have accorded with the purposes we have in view. They are not the learned but the unlearned that our labours are intended to enlighten. To those who are themselves versed in the sciences that bear upon the case, the following observations (with the exception of a few remarks which a practical acquaintance with the art has specially enabled us to supply) can possibly present nothing new; nothing, in short, with which they are not better acquainted, and of which they are not better able to judge than ourselves. It is to the general reader alone that we address ourselves, who, with equal capability of drawing conclusions, may haply be devoid of a proper knowledge of the grounds whereupon to construct them.

With this view we have studiously endeavoured to avoid the employment of all such terms of art as are not in use in common parlance, and otherwise to adopt a style and method as familiar and concise as is consistent with the clear exposition of the subject we have taken upon us to illustrate. In accordance with these principles, our intentions in the following investigation are to ascertain and define—

I. The obstacles which interfere with the active progress of the balloon.

II. The mechanical means required to surmount them.

III. The natural power by which those means are to be put in operation; and

IV. To point out certain regulations and restrictions by which they must be governed in their application in order to be really available for the purposes for which they are designed.

By this method of proceeding, one important conclusion at any rate we shall have established; namely, what are the means by which *alone* the direction of the balloon can ever be accomplished. Under what particular form these means may be applied, or whether indeed their application is within the reach of those powers which Providence has placed at our disposal, we leave entirely to the judgment and ingenuity of the reader himself to determine.

( I. )

The moment a balloon has cast off its last hold upon the solid earth and been received into the bosom of the air, it becomes at once, and, in the absence of all foreign interference, completely subservient to the same impulses and affected by the same impressions as those which govern the disposition of that element itself. To the actual amount of these, the varied and inordinate rate of the atmospheric currents, is to be attributed the whole of the difficulty that involves the question of aerostatic guidance. The mere tenuity of the medium, the want of a consistency sufficient to afford grounds for the establishment of a proper *point d'appui*, or fulcrum for the application of the requisite forces (which by most persons is inconsiderately regarded as the great obstacle to success), however it may avail to enhance the difficulties of pure mechanical flight, is literally of no importance whatever as regards the artificial propulsion of the balloon. The cases in this respect are entirely dissimilar. In the one, a force (the attraction) has to be overcome by another (the resistance of the atmosphere), with which it has no connexion, and which, therefore, there is no reason to suppose necessarily competent to the charge. In the other, the forces to be overcome and the means of overcoming them are the same,—namely, the resistance of the atmosphere; in proportion as the grounds of propulsion are feeble, the opposition against which they have to contend, and by which they are regulated in their amount, are feeble also.

Were it not, therefore, for the rate of the medium and the obligations it imposes upon the conduct of the operation, nothing would be simpler nor more certain than the mechanical direction of the balloon. Action and reaction being invariably equal, any exertion of the proper means, no matter how slight, must inevitably produce a determinate advance in its position; and that, without any regard to the direction of the medium in which it is conveyed.* It is true that where the disproportion between the resisting powers of the means

* In considering the case of a body advancing through the air, under the exercise of means of propulsion inherent in itself, the reader will bear in mind that neither the rate nor direction of the medium in which it is conveyed in any way affects its condition, or occasions it to suffer any sort of violence beyond what, with the same exertions on its part, it would experience were it to seek to advance *with* instead of *against* it. The idea of a vast and cumbrous machine struggling to maintain itself in the teeth of a rude and impetuous current, is likely to be a very different one from that of the same body calmly exercising the *same* force with the advantage of the wind to second its exertions. The distinction, however, so far as the condition of the body is concerned, is a false one. Differing in this respect from other locomotive machines, all the forces by which it is operated upon are determined by its own exertions alone, proportioned to the rate and opposed to the direction which they seek to establish.

of propulsion and those of the machine whose movement was to be the result of their operation was extremely great, its actual progress would be extremely small; some, however, little as it might be, would positively be realised, and the only question would be how far the advantages obtained were worth the exertions employed to secure them.

With an independent motion, however, in the medium of its conveyance, the guidance of the balloon to any extent is by no means a necessary consequence of any exertion of forces with which it might be possible to invest it; and this it is which constitutes the great difficulty by which aerial navigation is beset, and by which it is so unfavourably distinguished from almost all other known modes of transport. If a steam-engine, for instance, should be competent to propel a carriage even at the slight rate of only a mile an hour, still the means employed might be considered as successful to that extent at least, and the machine, though comparatively inefficient, yet, as far as it went, available to purposes suited to its power. Such, however, is by no means the case with the balloon; the progress conferred upon it by foreign forces, be it ever so great, can never be set down as so much gained, nor can the means of its propulsion be considered as successful to *any* extent that are not so to a *given* one. Acting in and under the influence of a medium, itself endowed with rapid motion, a very considerable degree of velocity might be acquired by the balloon without any actual gain at all; and, were we to take extreme cases, the greatest rate of motion ever enjoyed by any terrestrial object might be conferred upon it, and yet so far from advancing it might be absolutely a loser in point of space from where it was ere it commenced its career. Before the balloon, therefore, can make sure of obtaining any advantage whatever from the exercise of its means of propulsion, it must be able at all events to command a rate of motion superior to that of the medium in which it is conveyed.

The movements of the atmosphere, with which alone we have here any concern, are, as we all know, a most variable quantity, comprising within their limits almost every degree of velocity with which we have any practical acquaintance, and pervading (so far as we have any right to conclude) all those regions which, from their proximity to the earth, constitute the proper sphere of the balloon.

I am aware that an opinion is very prevalent among aeronauts, and which is also favoured by some meteorologists of distinction (especially those of Germany and France), that all these changes are confined to the lower regions of the atmosphere, and that beyond a certain elevation, a state of perfect, or at least comparative, tranquillity may be looked upon as the natural condition of the ethereal space. To what to ascribe the origin of this opinion I am totally at a loss to conceive, unless indeed it may be to that innate disposition in men to believe what they desire to be true, and to adopt, without questioning, whatever appears to favour their particular predilection. The supposition, however, is by no means borne out by facts: on the contrary, many instances might be adduced from the registered annals of the art, in which considerable excitement has been found to prevail in the upper regions of the atmosphere; at a time, too, when, comparatively speaking, no motion whatever could be perceived in the portions adjacent to the surface of the earth. In one of the two ascents which Signor Lunardi executed from Heriot's Hospital Grounds, at Edinburgh, notwithstanding a state of perfect tranquillity uniformly prevailed below, the rate of the balloon's course at the greatest altitude to which he arrived exceeded seventy miles an hour [see p. 106 of this work]. On the 28th of April, 1802, Captain Sowden, in company with M. Garnerin, ascended from the Ranelagh Gardens, near London, and after continuing at a very considerable elevation, in three-quarters of an hour descended near Colchester, a distance of sixty miles; having thus accomplished a rate of motion equal to eighty miles an hour, although scarcely any could be perceived at the immediate surface of the earth [see p. 115]. A still more striking proof of the existence of rapid atmospheric currents at excessive elevations, and one which appears to be decisive on the subject, is afforded in the second ascent of M. Gay-Lussac from Paris, in which a very considerable rate of motion was accomplished, although the whole of the voyage, with the necessary exception of the ascent and descent, was conducted at an altitude bordering upon twenty-three thousand feet, the greatest to which any balloon has hitherto been known to arrive [see p. 120]. It is unnecessary to multiply examples to disprove the truth of a general rule; enough has already been adduced to determine the fact that, at the greatest elevation ever attained by man, very considerable atmospheric currents have been proved to exist. What may be the case at a still higher elevation we must leave to future experience to determine; in the mean time we must continue to regard the atmosphere as we have found it; and, in our treatment of the question before us, consider the aerial vehicle as liable to the influence of those forces which have hitherto proved superior to all the efforts by which it has been attempted to subdue them.

These forces then are, as I have said before, of a very variable disposition, embracing within their limits

almost every degree of motion with which we are practically acquainted, from a state of perfect quiescence to the enormous rate of one hundred miles an hour. Such a rate of motion, it is true, is very uncommon; and, in our climate at least, of such rare occurrence that it could not be imputed as a valid objection to any plan for the guidance of the balloon, that it was not calculated to meet so extreme a case as that which we have here specified. The average rate of the wind in these climates (which we have chiefly in view in the following treatise), may be said to be about twenty-five miles an hour. This we are enabled to determine, not from the observations of the meteorologist alone, but (what is more to the point, because founded upon experience in a part of the atmosphere with which we have more especially to do), from a consideration of the average rate of Mr. Green's aerial excursions, deduced from a series of two hundred and forty-nine voyages, executed generally in the most favourable periods of the year. From this we learn that twenty-five miles an hour * is the mean rate at which a body floating in the atmosphere may be expected to be transported; and with resources to that extent would it be necessary to be provided, were the *average* amount of the obstacles to be taken as the measure of the means to be employed in surmounting them.

But the average amount of the antagonist forces, however it might be deemed a sufficient gauge in the case of other locomotive machinery, could by no means either prudently or properly be admitted as an adequate allowance in that of the aerial conveyance. The powers by which the progress of the balloon is liable to be affected are so vast, that were she only provided with the means of resistance upon so limited a scale, the deficiency in extreme cases would involve consequences far beyond what the exercise of her own resources could ever enable her to retrieve. No argument can be drawn from a consideration of what would be reckoned sufficient, in other cases (in marine navigation, for instance), to sanction the admission of the same scale whereon to measure the means required for the guidance of the balloon. The extreme rate of a current at sea, never, I believe, reaches ten miles an hour; † that of the atmosphere in motion, I have before observed, occasionally amounts to one hundred miles in the same time. The actual consequences, therefore, to a ship furnished with means equivalent to half of what she might have to encounter, would be but trifling compared to what a balloon would suffer in a similar emergency and similarly provided to meet it. Each, it is true, would lose but one half of her way; but the half of her way lost to the ship would be only equal to five miles an hour, and the result but the retardation of a few days at the utmost in the date of her arrival at her destined port. The loss of half her way to the balloon would amount to fifty miles an hour, and the probable result would be that she would have reached the antipodes ere any circumstances might have occurred to favour the recovery of her course.‡

From the consequences of an inadequacy to contend with superior forces, the balloon again has none of those shifts to relieve her, such as oblique sailing, tacking, or even temporarily suspending her progress, to which the mariner can resort in similar cases, and which enable him to put up with a comparatively inferior power. If the force which opposes the balloon she is unable to subdue by direct opposition, she must be content at once to submit to the consequences of defeat. This is the more necessary to be insisted upon, because I have generally found persons resort to such arguments, in order to bolster up a feeble scheme of aerial navigation; flattering themselves that, although they might not be able to accomplish a progressive motion in direct opposition to a powerful current, they would be able to take an angle and traverse it obliquely, as a ship tacks against a wind; or, should that fail, come to an anchor, and thus remain neuter during the predominance of the powers they are unable to contend with.

The expedients, however, to which they advert are totally inadmissible, and, with regard to the former, absurd. Tacking, as practised at sea, is an operation requiring the presence of two independent media, and may be defined, the taking advantage of one of them (the water) to secure a *direction* for the exercise of the force obtained through the intervention of the other (the air); such a resource is as inefficient with the aid of one medium only, as the action of the male screw would be without the female, or the lever without its fulcrum. If a balloon canno

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* The total distance which Mr. Green accomplished in the course of his first 200 aerial excursions, a very accurate computation enables him to fix at 6000 miles; and the time consumed in the performance at 240 hours. The former of these two quantities divided by the latter gives the quotient above mentioned.

† The currents proceeding from the action of the tides, which occasionally accomplish a much higher rate of motion, are not, nor should they be, here taken into account; inasmuch as, from their very nature, alternating successively in two opposite directions, they invariably neutralise their own influence every twelve hours, and cannot really be said to have any effect upon the course of a vessel whose voyage is intended to endure for more than half the above period.

‡ See Note A, by M. Monge, at end of this paper (page 332).

make head against a current of air in direct opposition to its course, it only aggravates the mischief by any attempt to meet it obliquely.* †

With regard to the other expedient alluded to, namely, the temporary discontinuanee of the course of the balloon whenever the condition of the atmosphere should happen to exceed its powers of resistance, the idea is replete with practical impossibilities. The moment a balloon is inflated, the worse the weather the more urgent is the necessity for her immediate departure; every moment she delays teems with risk, and should the forces in question be excessive (which, indeed, is the very contingency contemplated in our argument), the only chance of her security is in the air. These are objections which the inexperienced reader cannot be expected to appreciate, but which all those who have any practical acquaintance with the details of the art will be ready at once to admit. If they are conclusive against the possibility of adopting the step here alluded to, with a balloon of the ordinary simple principle and advantageous construction, how much more so must they be when applied to one fitted up with the vast and cumbrous apparatus required for its propulsion, increasing the liability to damage exactly in the ratio of the inability to resist it. The expedient, in short, is one which never could be resorted to except when it was unnecessary, and never could be necessary except when it was impracticable.

The extreme rate of motion with which it may fairly and reasonably expect to have to contend, must, therefore, be had in view in all schemes which propose to render the balloon a certain and serviceable mode of transport, and at any rate as much of it provided against as shall leave a deficiency within the reach of her own resources to repair.

From a consideration of all the bearings of the case, and desirous as much as possible to favour the hopes of an aerial navigation, I am bound to say that unless the balloon can command a rate of motion equal to thirty or thirty-five miles an hour, it cannot claim to be considered as a mode of transport applicable to useful purposes, or on a par in point of advantages with any of those whose services it might be expected to supersede.

Now all this velocity, it is evident, cannot be accomplished without the development of a certain force of resistance, which is in fact the very measure of the difficulty we have hitherto been labouring to ascertain. This resistance is chiefly of two kinds; the one, the direct impact of the atmosphere,—the other, the friction occasioned by the action of its particles along the surface of the opposing body; both of which are determinable as to their amounts by a consideration of the form of the object and the rate at which it is impelled.

1. The former of these, the direct impact of the atmosphere, is by far the more serious obstacle of the two, and that against which the efforts of the aerial engineer have hitherto been almost exclusively directed. In a previous page [see p. 161 of this work], we have taken some pains to point out in what manner and to what extent the form of the body is capable of modifying this force, and have within certain limits established a rule by which to determine the comparative amounts of atmospheric resistance upon bodies opposing plane and conical surfaces to its action. To avoid, therefore, entering anew upon the same ground we shall only observe generally, that from one-half to one-third less opposition is realised by a hemisphere, or cone of equal altitude with its base, in passing through the air, than would be experienced by a plane surface equal in extent to its largest section, taken at right angles to the direction of its course. The conditions of this latter force (I mean, of the resistance afforded by the atmosphere to the impact of a *plane* surface), have already been pretty accurately investigated, and its amount, corresponding to the rate of the medium, determined by experiments ingeniously devised and carefully instituted,

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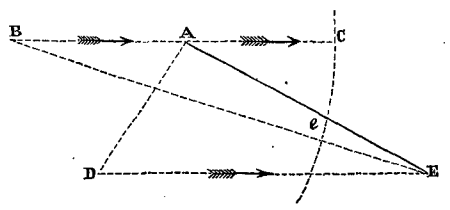
* The examination of the following Diagram will render this conclusion more apparent:—




Suppose a body freely suspended in the air and capable of accomplishing a rate of motion equal to *ten* miles an hour, were to set out from the point A, with the intention of proceeding in the direction of A B, against a wind moving at the rate of *twenty* miles an hour; by the time it had attained the point B in the body of the atmosphere, that point itself would have been transferred with the progress of the medium to a spot corresponding to C upon the surface of the earth; the course of the body would be represented by the line A C, and the loss of way would be equal to the difference between the two rates. Were the body, with a view to avoid the direct opposition of the air, to take an angle and seek to advance in the direction A D, by the time it had reached the point D in the body of the medium, that point would have been transferred to E on the surface of the earth; the course of the body now would be indicated by the line A E, and the station it had acquired would be further removed by the distance *e* E from the point B, which it had first aimed at, than if it had proceeded thither in direct opposition to the wind.

† See Note B, by M. Marey Monge, at the end of this paper (p. 333).

for all degrees of the scale, from one to one hundred miles an hour. It is scarcely necessary to observe, that whether the impact be effected by the motion of the body or simply that of the medium, the result, as far as concerns the amount of force produced, will be the same; and that, consequently, the pressure of the atmosphere, as displayed in the phenomena of the winds, may be taken as a correct measure of the resistance which, at the same rate, the balloon would occasion for itself, were it alone to be endowed with motion. For the benefit of those who may feel inclined to enter more at large into the calculations connected with the subject, a specification of this force, as determined by the experiments of Messrs. Rouse and Smeaton, has been subjoined below.*

From this Table it will be seen, that for every square foot of *plane* surface called into action at the rate of one mile an hour, the atmosphere exerts a resistance equal to five-thousandths of a pound avoirdupois; a force which is found to increase accordingly with the squares of the velocities under which it is exercised. To give some idea of what this force would be in practice, let us assume the case of a balloon of known dimensions; that, for instance, belonging to the managers of Vauxhall Gardens, with which the public are no doubt by this time pretty well acquainted. This balloon is a spheroid of about sixty feet in height and fifty in breath; in computing its powers of resistance, however, we shall not much err if we regard it as a sphere, whose diameter is equal to the mean of these two quantities. Upon this hypothesis, then, the plane of its largest section would contain about 2372 square feet, the resistance upon which, however, owing to its particular form would, as we have before observed, be only equivalent to that upon a plane two-thirds its dimensions, or about 1581 square feet. Multiplying this sum by the amount in the subjoined Table corresponding to any degree of velocity, we shall have at once, and with very considerable accuracy, the amount of the whole force by which its progress at that rate is affected; or, in other words, the resistance it would offer to the atmosphere, or the atmosphere to it, were either to be arrayed against the other in motion at the rate in question. Thus, at the rate of thirty-five miles an hour, which we have already agreed to consider essential to the successful progress of the balloon, the opposition experienced would be $1581 \times 6{\cdot}027 = 9528$ pounds avoirdupois, or upwards of four tons and a quarter.

The proportion between the force here computed, and the buoyant power of the balloon might, it is true, be considerably reduced, by the adoption of another form for the containing vessel, which should afford a less direct resistance to the impact of the atmosphere; such a modification as indeed would be necessary to render it manageable under any circumstances. Were, for instance, the contents of the sphere in question thrown into an envelope of the form of a cylinder capped at the extremity with cones, or an ellipsoid in length four times the diameter of its transverse section, we should have a vessel equal in buoyancy to the former (omitting the difference in the weights of their respective coverings), presenting an active resisting surface of only one-half the amount. Even here, however, where the arrangement of the parts is, I believe, the most favourable to the reduction of the force in question which it is possible to imagine consistent with the other exigencies of the case, the resistance to its progress at the rate required would be equal to 4764 pounds.

2. To counterbalance in some degree the advantages, which, it is evident, here accrue from the adoption of a form less favourable to the direct impact of the atmosphere, another force remains to be considered in the *friction* which is engendered between the surface of the body and the particles of the medium in which it moves. The introduction of this force is, in fact, the necessary consequence of the arrangements by which the other is sought to be avoided. Friction being the resistance exerted by the passage of particles *over* and *along* a given surface, in contradistinction to that occasioned by their impulse *against* it, must evidently increase in proportion as the facilities

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* TABLE, showing the perpendicular force of the wind under different velocities, in pounds avoirdupois, on each square foot of plane surface, computed from experiments of MESSRS. ROUSE and SMEATON.

| Miles per Hour. | Pressure per Foot. | Miles per Hour. | Pressure per Foot. | Miles per Hour. | Pressure per Foot. | Miles per Hour. | Pressure per Foot. |
|---|---|---|---|---|---|---|---|
| 1 | ·005 | 8 | ·315 | 35 | 6·027 | 70 | 24·100 |
| 2 | ·020 | 9 | ·399 | 40 | 7·873 | 75 | 27·646 |
| 3 | ·044 | 10 | ·492 | 45 | 9·963 | 80 | 31·490 |
| 4 | ·079 | 15 | 1·107 | 50 | 12·300 | 85 | 35·550 |
| 5 | ·123 | 20 | 1·968 | 55 | 14·885 | 90 | 39·850 |
| 6 | ·178 | 25 | 3·075 | 60 | 17·715 | 95 | 44·401 |
| 7 | ·242 | 30 | 4·429 | 65 | 20·791 | 100 | 49·200 |

The terms of the scale answering to the rate of the wind at 6, 7, 8, 9, 55, 65, 70, 75, 85, 90, and 95 miles an hour, which have hitherto been omitted, are here supplied.

for the latter operation become lessened by the particular construction of the opposing surfaces. If an open umbrella be held point foremost towards the wind, almost the whole of the force directed against it will be that of impact; if it be now gradually closed without altering its direction, the force of impact will become converted by degrees into that of friction, and will give place to the latter almost entirely when the collapsion has become complete. In bodies, therefore, where the force of impact is paramount, that of friction is at a minimum, and *vice versâ;* in the intervening stages, alone, it is that both act in conjunction. The former of these being the more serious obstacle of the two, it evidently becomes the interest of the aerial navigator to construct his vessel in such a manner as shall leave him as much as possible the latter alone to contend with; hence, the more perfect the scheme for the propulsion of the balloon, the greater will be the share of the opposition to its progress, arising from the source in question.

To the reader not versed in the physical sciences it may perhaps seem strange that a resistance of such importance as to merit the consideration we have bestowed upon it, should be capable of being generated by the attrition of the particles of an elastic fluid of such slight consistency as that of the medium of the aerial conveyance. The influence, however, of atmospheric friction on the motion of bodies adapted to experience it, is unquestionably very considerable, and often productive of effects in cases where it escapes notice. It is this that, in conjunction with the attraction of gravitation, determines the course of the arrow shot from the bow, or the spear launched from the hand, which, from the minute and almost insensible impact they are calculated to experience, would otherwise be almost without a limit. To what extent it would operate in retarding the progress of the balloon—how much would have to be added upon that score to the opposition arising from the direct impact of the atmosphere—can only be ascertained by actual experiment in each particular instance. The purpose of our present observations is merely to point out the existence of such a force, and explain in what manner it affects the question of aerial navigation by the limitation it imposes upon the unconditional reduction of the obstacles upon which its chief difficulty depends.

( II. )

To enable the balloon to maintain its course in the teeth of the opposition we have just been endeavouring to compute—or, more properly, to command a rate of motion whereof the opposition in question is the index as well as the result—it is absolutely necessary that it should be provided with the means of creating a reaction in the surrounding atmosphere equivalent to the resistance it will have to encounter in its employment: without a reaction there can be no propulsion; and, unless the forces developed in the proceeding be commensurate with those by which the balloon itself is liable to be affected at the rate required, they will not avail to establish a progressive motion independent of that of the medium in which they are exercised.

There are, I am aware, other means of investing matter with motion besides that which proceeds from a reaction in the medium of conveyance; namely, by a resistance generated inherently and determined in a given direction by the particular construction of the parts. Such, in fact, is the force by which the ascent of the sky-rocket, the transmission of the cannon-ball, the operation of the piston and cylinder, and, lastly, the impetuous discharge of gas or steam, however different may be the *natural power* by which they are first called into action, are all accomplished. The incompatibility, however, of the principles upon which they all act, with the other essential conditions of the case, as will be seen farther on, will, I think, be sufficient to excuse the rejection of all such means from our consideration, and sanction the limitation within which we have confined the prospects of aerial navigation to the simple establishment of a reaction in the medium in which it is to be conducted.

We have already seen how completely all atmospheric resistance is absent from the natural career of the balloon; how entirely the motions of the two bodies coincide when unimpeded by the interference of any foreign agents. From this it will be evident that no simple disposition of the parts, in the form of sails or otherwise, however effective they may be in marine navigation, can be of the slightest avail in the present question. With nothing to act upon them different from what acts upon all the rest of the body besides, they can be considered in no other light than as merely so many variations in the form of the aerial machine, and can be of no more service in determining its progress than oars, simply resting in the water without exercise, would be in affecting the course of a boat, as it drifted upon the bosom of the waves.

The reaction in question can therefore, it is evident, proceed from no passive arrangement of the parts, but must be actively engendered by the exercise of a force distinct from any to which the simple progress of the body itself is capable of giving rise. To this effect a certain extent of surface must be arrayed in motion so as to impinge

upon the adjacent strata of the surrounding medium, and in the opposition it encounters, establish, as it were, a fulcrum for the leverage by which the machine is to be substantially propelled. Under whatever form the ingenuity or caprice of man may induce him to order his devices—whether in the guise of oars, wings, or paddles, designed to operate by reiterated percussion, rotation, or by continuous impression, as exemplified by the involutions of the spiral sail or vanes formed after the fashion of the screw—all resolve themselves into this one principle; namely, the impact at a certain rate, of a certain extent of surface against a resisting medium.

In the construction of this force, therefore, two elementary principles present themselves for consideration; namely, the *surface* and the *motion* conferred upon it. To a certain extent these two principles are vicarious of each other, and may be indifferently employed to produce the same results. For instance, if a machine, by the operation of a given amount of surface, at a given rate, is able to communicate a certain speed, the amount of this speed will be equally affected by an alteration in the dimensions of the surfaces in question, or in the rate at which they are made to operate. To a certain extent alone, however, this is true; for independently of the necessity there is for a certain amount of each, no multiplication of the size of the surfaces could ever enable them to impel the body at a rate of motion greater than that which they were themselves at the time endowed. Thus a body impelled by means of a series of revolving planes, as in a paddle-wheel, striking the air at the rate of ten miles an hour, could by no amplification of the dimensions of the surfaces be enabled to realise a rate of motion exceeding ten miles an hour; inasmuch as the moment it had attained that rate of motion, all reaction between the surfaces and the air would cease; or if continued beyond that rate, would be transferred from the back to the front of the impelling surface, and operate to retard instead of advancing the body to which it was attached.

But though a limit is thus imposed upon the extent to which an augmentation in *size* may be made to supply a deficiency in the rate of the impelling agents, no such limitation exists in theory to the extent to which an increase in the *rate* of impact may be made to compensate for an abridgment in their dimensions; the smallest amount of surface being capable of realising any amount of resistance providing the rate of its impressions be accelerated in proportion to the demand. Before, therefore, we can come to any definite conclusion with respect to the size of the agents of the propulsion of the balloon, it will be necessary that we investigate and determine the conditions by which the rate of their impact is governed. Should it appear from such an investigation that this rate is not more than it may fairly be expected to accomplish, it will then be open for consideration whether a still further increase may not be made subservient to a reduction in the size of the impelling planes. If, however, on the other hand (as, indeed, I fear will be found to be the more probable conclusion of the two), the velocity required for the fulfilment of the obligations alluded to be as much or more than is capable of being attained in practice, then will the conditions of size and rate assigned upon such grounds be the lowest in conformity with which the successful guidance of the balloon can be accomplished.

1. With regard to the *motion* of the impelling surfaces, therefore, one important point is already established; namely, that whatever may be their actual condition as to size, number, or powers of resistance, the rate of their impact must not be less, at all events, than that required as the final result of their operation; in other words, than the rate assigned to the balloon itself. Admitting the correctness of the conclusion to which we have arrived in the preceding section respecting the rate of the balloon, this obligation alone tends at once to fix upon the agents of the propulsion a velocity of action amounting to between thirty and thirty-five miles an hour.

In proceeding, however, to accomplish this rate of motion by the exercise of the mechanical means we have before laid down as essential to the purpose, another force becomes developed, tending to impair their efficiency and imperatively calling for a further accession to the velocity with which they are required to act. This force, which is precisely analogous to the "back-water," observed at sea in the case of vessels impelled by steam, proceeds from a condition induced in the atmosphere by the action of the impelling surfaces themselves, whereby the adjacent portions become determined in a continuous stream, mainly opposed to the course of the machine, and with a velocity proportioned to the scale upon which the operation has been conducted.

The explanation of this process is extremely simple, although the circumstances by which it is attended are so complicated as to baffle any attempt to calculate the precise amount of the obstruction. In the atmosphere, as in all other fluids, elastic or non-elastic, a certain uniformity of condition necessarily obtains. Whenever this uniformity happens to be disturbed, either by natural causes or the interference of foreign agents (as in the present case, by the rapid action of large resisting planes), a general tendency is immediately manifested in all the neighbouring parts to rush in and restore the equilibrium; in the course of which all the same symptoms are evolved, and the same

effects produced as would attend the exposure to a natural current of air. The consequences of this disturbance upon the progress of the balloon are too apparent to need explanation, although the extent to which it would be necessary to increase the speed of the impelling surfaces, in order to counteract its influence, and enable them to realise the required momentum, would not be possible without actual experiment precisely to ascertain. From a critical consideration of the several circumstances of the case, however, I do not hesitate to conclude that an augmentation of at least thirty per cent. in the rate of the impelling agents would not be more than enough to compensate for the disadvantages under which they labour upon this account, and place the machine, as far as regards the efficiency of its means, upon a par with what it would be were no such obstruction the natural consequence of its exertions. Thus assuming the accomplishment of a rate of motion equal to thirty-five miles an hour to be essential to the successful progress of the balloon, the surfaces by which that result is to be realised must impinge upon the atmosphere with a velocity of not less than fifty miles an hour.

To the sufficiency of this estimate, however, another consideration is necessary; namely, that this impact be maintained at the rate appointed throughout the whole period of the operation: in other words, that no interval or intermission be allowed to take place in the action by which it is generated, whereby the velocity be less at any one period than what is understood to be essential to the accomplishment of the progress required. The necessity for this stipulation will appear the more readily when we consider that the resistance experienced by the balloon is liable to no such periodical suspension; but, such as it is, may be generally considered as incessant in its operation; at the rate for the time presumed. Whenever, therefore, any cessation or abatement is allowed to take place in the action of the impelling agents, a temporary ascendancy is conferred upon the opposing forces, and a corresponding reduction occasioned in the progress of the machine. To obviate this deficiency and secure a given amount of velocity in all schemes in which the agents of the propulsion operate by reiterated percussion (as exemplified in the case of wings or oars), a further accession must be made to the rate at which they are required to act, proportioned to the interval allowed to elapse between the periods of absolute impact and to the difference which that interval is calculated to produce in the momentum of the body, already considered to be fixed at the lowest which the exigencies of the case will permit.

2. When a body is set in motion by the exercise of its agents of propulsion, whatever may be the proportion the resisting surface of the one bears to that of the other, or the difference between the rates at which their impressions are effected, the amount of resistance experienced by each will be invariably the same. Thus, if an individual seated in the car of a balloon operate upon the adjacent atmosphere simply by means of a lady's fan, a rate of motion, however insensible, will be inevitably induced in the former sufficient to generate an amount of resistance exactly equal to that exerted against the surface of the latter; the only difference being, that in the one case it is concentrated upon a *smaller*, while on the other it is diffused over a *larger*, extent of surface, and thus by the infinite participation of its effects escapes detection. From this (which is, in fact, but a deduction from the well-known maxim of the equality of forces in action and reaction), it follows that to enable the impelling agents to bring up the balloon to a given rate of motion they must be competent to the production of the *same amount* of resistance as the opposing surface or surfaces of the balloon itself, in progress at the rate required.

This result, as we have before had occasion to observe, might (circumstances permitting) be attained equally by a modification of the superfices themselves, or of the rate at which their operations are conducted. From what has, however, been established in the preceding section, I think it will be readily conceded that, admitting even the possibility of the accomplishment of the velocity there assigned to them, we should not be justified in looking to that quarter for any further augmentation by which to enable us to dispense with any portion of the dimensions of the propelling agents which *at that rate* would be necessary to the generation of the required resistance. Now, the rate in question being equal, or rather *equivalent* to that of the balloon,* and an equal amount of resistance being required as the result of the operation, it follows that the surfaces of the agents by which that result is to be obtained must be equal in extent or *equivalent* to those of the balloon itself.

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* It is true that we have assigned a much higher rate of motion to the mechanical agents of the propulsion than that specified as the terminal velocity of the balloon itself; the cause of this distinction, however, being the reduction in the resisting faculty of the medium of the propulsion, occasioned by the natural and necessary condition induced in it by the process itself, in the benefits of which reduction the object to be propelled does not participate, the rates, however different, must be looked upon as the same; being, in fact, only equal to the production of the same amounts of resistance.

In determining, however, the size of a surface,* by which a given amount of resistance is to be generated at a given rate of motion, regard must be had to the *form* and *structure* of the parts by which the impact in question is to be effected. Upon this head we have already had occasion to comment rather largely on another occasion, and more slightly in the first section of the present treatise. From what has been there stated, it appears that in creating an impression upon the atmosphere, a plane (and, *a fortiori*, a concave) surface has an advantage over one of a convex or conical construction, varying according to circumstances from one-half to one-third of the whole amount. To that extent, therefore (were there no other obstruction to the progress of the balloon than that arising from the direct impact of the air), might we expect to be able to reduce the proportion between the superficial dimensions of the impelling agents and that of the balloon, in favour of the former. From the nature of the proceeding, however—the complicated construction and extended lateral surfaces of the balloon, modified as it would have to be to suit the purposes of aerial navigation—a considerable amount of resistance, consisting both of friction and impact, would be developed beyond what a calculation founded upon a consideration of the shape and area of its greatest opposing section would lead us to infer. To meet these accruing demands an augmentation would have to be made in the relative dimensions of the impelling agents, which would remain to be determined by a reference to the particular conditions of the case and the aptitude of the parts to perform the functions allotted to them. Presuming, however, that as far as the *forms* of the parts are concerned, every opportunity would be taken to turn them to the best account—that the surfaces designed to effectuate the resistance and those whose object it is to evade it would be constructed in the manner most favourable to the interests of each—we may set it down as conclusive that from two-thirds to three-fourths the actual size of the latter would be necessary to enable the former to generate by their impact an equal quantity of resistance.

In addition, however, to the resistance occasioned by the simple progress of the balloon, there is another obstruction which claims to be provided against by a further extension of the proportions assigned in favour of the surfaces of the impelling agents. This obstruction arises from the necessary opposition experienced by the parts of the latter in the act of recovering their positions, preparatory to the repetition of the stroke by which the propulsion of the balloon is accomplished. Thus, for instance, supposing the machinery employed for the purpose to partake of the nature of the paddles of the steam-vessel, rotating upon an axis, while one portion of the apparatus is impinging upon the atmosphere in a direction *favourable* to the end in view, another is inevitably impinging in a direction precisely *opposite*, and with an effective velocity exceeding that of the former by a quantity equal to twice the actual rate of the balloon at the time.† This is a conclusion which can never be entirely avoided. No matter how ingeniously devised or how perfectly constructed, a certain amount of surface must ever be presented to the action of the atmosphere in the manner above mentioned, and operate more or less to detract from the value of the forces which it is able to command. How much it would be necessary to extend the dimensions of the impelling agents to counteract the effects arising from this obstruction, experiment alone could accurately enable us to ascertain. As a conclusion, however, which though not expressly deducible from actual calculation is fully warranted by a consideration of the case in all its bearings, it may be laid down that, in order to overcome the resistance occasioned by this in conjunction with other obstructions of minor importance (but which in our general view of the subject it is not necessary at present to particularise), the area of the impelling planes should at least be equal in extent to that of the perpendicular opposing surface of the whole machine itself. Thus, for instance, in the case of the Vauxhall balloon, before quoted, in order that the impelling agents might be able to confer upon it the rate of motion specified

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* The *size* of a surface in relation to its powers of resistance, which is the sense in which it is here used, is a plane equal to the sum of the projections of all the parts by which the progress of the body is impeded, taken at right angles to the line of its propulsion. When the form of the body is simple, this plane resolves itself into a section of the body at its point of greatest lateral extension, or such as its shadow would appear upon a plane surface directly behind it. In bodies of a more complex construction the size of the plane in question is not so easily determined. All parts which project beyond the neighbouring ones, however they may be covered by the intervention of others, receive to a certain extent the impact of the air, and must be considered in the estimate of the surface contemplated in the above definition. The circumstances by which the resistance of the parts so disposed is governed—namely, their relative magnitudes and positions, the degree of shelter they obtain, and the state of the medium when it has reached them—are too vague to permit us to assign any general rule but that of experiment, whereby to determine the exact share they may have in the operation, and how much should be added upon that score to the size of the surfaces by which they are to be matched.

† The medium virtually receding as the body advances, the amount of its velocity (= the rate of the balloon) will have to be deducted from that of all bodies proceeding in the *same* direction and superadded to that of those proceeding in a *contrary* one. The sum of these two quantities (= twice the rate of the balloon), constitutes therefore, the difference between the rates of impact of the parts of the machine proceeding in opposite directions.

as essential to the success of the operation, they must present to the continuous action of the air an extent of plane surface equal, at the least, to sixteen hundred square feet.

In assigning this proportion to the dimensions of the resisting surfaces, it must not be forgotten that much of its sufficiency will depend upon the condition with regard to *continuity* or compactness of the parts by which the impression of resistance is effected. A given extent of surface, distributed into several portions, is by no means productive of the same amount of resistance as if it had been disposed in one uniform plane; neither is one whose contents bear a smaller proportion to the line that bounds them equivalent to one of the same dimensions within the smallest amount of margin by which it was possible to be enclosed. How far again this circumstance would operate to affect the proportion in question, in the absence of actual experiment, can only be conjectured. Regarding, however, the essential conditions of the case, such as we *know* they must be—the uniform bulk of the balloon, and the necessary disjunction of the parts by means of which it is to be impelled—there will be, no doubt, something to add on this score to the allotted dimensions of the latter, which, for the present, we shall only consider as contributing to support the necessity for observing the proportions we have before laid down.

( III. )

To put all this machinery in motion, and confer, as it were, animation upon the lifeless mass, a certain *natural power* is required, the amount and conditions of which it becomes our next duty to investigate. If rapid motion, independent of great force, or great force apart from rapid motion, were all that was sought to be established in the agents of the propulsion, but little difficulty would exist in appointing the means by which it was to be accomplished. By a proper combination of machinery, the smallest conceivable amount of force beyond what is necessary to overcome the inert resistance of the parts themselves, may be so multiplied in its efficiency as to be made to conduce to results in either extremes limited only by the nature of the materials upon which it has to act. A single individual exercising a force equal to one hundred pounds only, by the intervention of a system of six wheels, the circumferences of each bearing to those of their axles the ratio of ten to one, might be made to raise a weight of a hundred million of pounds, or nearly forty-five thousand tons; while, by reversing the action of the apparatus, a rate of motion would be communicated from one extremity of the machinery to the other, a million of times greater than that of the power itself by which it was generated.* It is only where both are required to be included in the same operation—where the resistance and the rate, as in the present instance, are both terms of the same proposition—that any limitation exists with regard to the results, or any obligation is imposed upon the means by which they are to be attained.

To those who are acquainted with the principles of the sciences concerned in the case, this conclusion will be at once apparent: for the benefit of others it may be as well to observe that, as it is only by the sacrifice of one or other of the constituent principles of the momentum they are required to communicate (either the velocity or the quantity of matter) that the mechanical powers operate in varying the result of the original impression, whenever a limit is assigned to the extent to which either of these principles may be reduced, a limit is likewise assigned to the advantages the mechanical powers can confer, which draw their influence exclusively from its reduction.

To apply these observations to the present question, we have already seen that in order to impel the Vauxhall balloon through the air at a rate of thirty-five miles an hour, a rate of motion in the agents of the propulsion equal to fifty miles an hour is required, generating a resistance equivalent to the weight of nine thousand five hundred and twenty-eight pounds, or nearly four tons and a quarter. If, instead of this double obligation, it had been simply required to effectuate a resistance equal even to one thousand tons, or a velocity of action amounting to as many miles an hour, the object might easily be accomplished (barring the imperfections of art) by the well-directed efforts

* Supposing the absolute radii of the wheels to have been ten inches, and those of the axles one inch, then multiplying the former successively into each other, we shall have $10^6 = 1{,}000{,}000$ as the value of the leverage in favour of the *power*, and one (the product of the continued multiplication of the axles), that in favour of the *weight*. Taking then, as above, 100 pounds to be the power of the individual, we have 1 : 1,000,000 : : 100 : 100,000,000, or somewhat more than 44,642 tons, the weight he would be able to sustain. The velocity, however, being decreased in proportion to the augmentation of the weight, as much as the latter *exceeds* the amount of the original impression, so much will the rate it moves at *fall short* of that of the generating force. In the present case this is a million-fold; consequently, such will be the difference between the rate of a point in the circumference of the first wheel and that of one in the circumference of the last axle. Supposing, then, the influence of the *power* be suspended or removed, the *weight*, in its preponderance reversing the action of the machinery, would communicate to the *locus* of the former a velocity a million-fold greater than that with which it was, itself, at the time endowed.

of a single individual. As it is, however, no such conclusion is necessary; the mechanical multiplication of the original impression by the sacrifice of the antagonist principles has already been determined by the appointment of their limits; all further accessions can only be obtained by an *actual* augmentation of its amount. Should the pressure, therefore, which it may be convenient or possible to command, fall short of four tons and a quarter, it must be of such a nature as to develop itself with a rapidity exceeding fifty miles an hour by an amount equivalent to the difference; on the other hand, should the rate of its generation be less than fifty miles an hour, it must exceed four tons and a quarter by a quantity sufficient to compensate the deficiency.

With these facts in view, very little consideration is required to determine the impossibility of effecting the guidance or propulsion of the balloon, to any beneficial extent, by a force originating in the exercise of human strength. This, indeed, is a conclusion which might have been arrived at without any such elaborate computation, by simply reasoning upon grounds deduced from observation and experience; and, indeed, the wonder is, that with so many and such palpable testimonies of the inadequacy of the powers in question, any one should ever have contemplated their employment, or contrived plans, with no more sufficient means to accomplish their execution. Every one who has ever been present at the ascent or descent of a balloon, must have been struck with the display of human force which the occasion is calculated to call forth; the number of men employed in the operation, and the exertions they are compelled to make, at times even when the action of the atmosphere is so slight as otherwise would have escaped their notice. If so many persons, with all the advantages of a solid resting-place, and an unyielding medium for the direct transmission of their strength, can scarcely avail to maintain it in its place, how utterly inefficient must they be when transferred to an unstable fulcrum, and having to apply their force through the intervention of the body itself whose motion it is their object to control?

But the inadequacy of human strength to accomplish the guidance of the balloon is capable of a still more accurate determination. According to the observations of Professor Playfair, Emerson, and others, who have specially investigated the subject, a man of the ordinary powers, working at a wheel, is competent to raise a weight of thirty pounds, through a space of three feet and a half in a second of time, supposing him to continue his exertions for a period of ten hours a day. When the velocity, however, with which he is expected to operate is increased, the amount of resistance against which he can contend must be proportionately diminished; and, at the rate ascribed to the agents of aerial propulsion (namely, fifty miles an hour, or seventy-three feet in a second), could only be estimated at about one pound and a half;* that is, presuming him capable, at the rate in question, of overcoming the *vis inertiæ* and friction of the machinery with which he would have to contend.

By the substitution, however, of his legs instead of his arms, a higher degree of power might undoubtedly be obtained, and which might be still further increased were he accommodated with such an apparatus above his shoulders as would enable him to add some amount of muscular reaction downwards to that accruing from the sole exercise of his bodily weight. By this means, at the ordinary rate of walking (which may be roughly assumed at three miles an hour,† or somewhat more than four feet in a second), a man might, for a considerable length of time, exert a force equivalent to his whole weight, or about one hundred and fifty pounds; which, reduced in proportion to the increase in the rate (namely, from four to seventy-three feet in a second, or about eighteen-fold), would give a result of eight pounds nearly as the available extent of each individual's exertions.

The exercise of muscular strength, however, no matter how lightly it may be taxed, being limited in its duration, while the estimate upon which its amount has been determined is founded upon the supposition of its uninterrupted continuance, it would be necessary to be provided with such an amount in reserve as would suffice to maintain the same quantity of power in constant operation. Admitting, therefore, that a man could continue to work at the rate ascribed to him for one-half of his time, a double supply of men, at the least, would be absolutely requisite, whereby the amount assignable to each individual would in effect be reduced to only four pounds—a quantity bearing so small a proportion to the weight as to hold out no prospect of its ever being available in the practice of an art, the main condition of which is the attainment of extreme specific lightness. To illustrate this conclusion by reference to a particular case, we have already seen that the resistance experienced by the Vauxhall

* Seventy-three feet in a second (the rate required) being *twenty-one* times greater than that contained in the proposition upon which our estimate is founded, the weight which could be raised will be but a *one-and-twentieth* part of that referred to in the same proposition. Thirty, divided by twenty-one, gives very nearly the quotient we have above deduced.

† A man may walk at the rate of four miles an hour, but I doubt if he could exercise his legs in the mode which would be required in turning a wheel, with the same freedom and at the same rate as if he had merely a progressive motion to accomplish.

balloon in passing through the air at the rate of thirty-five miles an hour would be equal to nine thousand five hundred and twenty-eight pounds, or about two thousand four hundred times the amount of that ascribed to each individual; consequently to effect its propulsion consistent with the obligations we have already considered to be essential to the accomplishment of any beneficial result would require a force of two thousand four hundred men, or about two hundred times as many as her whole ascensive power would be competent to support; and *that*, too, making no allowance whatever for the weight of the machinery by which they would have to operate.

It is true, by the adoption of another form, a balloon requiring no more propulsive power than that we have made the subject of the preceding calculation, might be constructed capable of supporting four times the weight: even here, however, all that would be effected would be an increase to that extent in the efficiency of the cargo, which would still remain about fifty times as great as she would be able to support.

Nor is this a conclusion which could be avoided by *reducing* the size of the balloon, in the hopes of attaining a point in which the forces opposing and those opposed would be more on a par. On the contrary, the resistance varying as the *squares* while the buoyant power follows the ratio of the *cubes* of the diameter, any attempt to diminish the scale of the experiment but tends to magnify the disproportion between the difficulties and the means whereby they are to be encountered; an elliptical balloon of nine feet radius, equivalent only to a charge of two men (the smallest number consistent with what we have before stated to be necessary for the due continuance of the impression), developing at the rate in question a resistance of one thousand and twenty-four pounds, and consequently requiring an amount of human power at the value we have assigned to it, one hundred and twenty-five times as great as it is capable of raising. For the satisfaction of those who might expect a more favourable result, by *enlarging* the dimensions of the balloon, we have subjoined a calculation from which they will perceive that, in accordance with the obligations before laid down, the smallest number of men that could propel a balloon sufficient to support them would be about three millions three hundred and thirty-five thousand, and the smallest balloon that could carry men sufficient to propel her at the rate in question would be equivalent in its contents to a sphere of about three thousand two hundred and sixty-three feet in diameter.*

In default of human strength, the mind naturally reverts to the great agent of modern invention, the wonder-working power of steam. Independently, however, of the inconvenience and danger necessarily attendant upon the employment of a power requiring the aid of fire, there is one essential objection to steam which must for ever preclude the possibility of its adoption as an agent in the propulsion of the balloon; I mean the continual *loss of weight* from the consumption of fuel and the conversion of water into vapour, which more or less must ever attend its employment. The force of this objection will at once appear, when we consider that it is by the preservation of the equilibrium between her contents of gas and ballast she maintains her position in the air. Whenever that equili-

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* The following is a general formula for calculating the direct resistance upon all balloons, partaking of the nature of a sphere, cone, cylinder, or ellipsis:—Square the radius of the largest section perpendicular to the horizontal axis of the machine, and multiply by 3·1416; this gives the number of square feet in a circular plane equivalent to the said section. Of this, two-thirds only are to be considered as forming the real amount of the resisting plane (the actual resistance being upon an average diminished one-third, on account of the particular form of the opposing surface); which multiply by the sum answering to the rate of the wind in the table of atmospheric resistance, and the product will be the amount of direct resistance in pounds avoirdupois. Divide this sum by the number of pounds which, at the rate assigned to the agents of the propulsion, shall be found equivalent to each man's muscular strength, and double the quotient will represent the number of men required to effectuate the same amount of resistance at the same rate, supposing one change of men sufficient to perpetuate the operation.

By this mode of computation may be tested the conclusion we have arrived at in the text. As the buoyant power of the balloon follows the ratio of the cubes, while the superficies, and consequently the resistance, varies as the squares of the diameters, it follows that any alteration in the size of the balloon must affect the former more than the latter; if a balloon, therefore, is capable of carrying *exactly* the quantity of human power equivalent to the resistance she develops, she must be the *smallest* that can be constructed with such a result; inasmuch as any further reduction in her size would diminish her buoyancy more than her resistance, and she would then require more force to her propulsion than she would be able to carry. Now, considering a balloon of fifty feet in diameter, when properly inflated, to be sufficient to raise a weight equivalent to twelve men, by referring to the proportion between the cubes of their diameters, we shall find that one of three thousand two hundred and sixty-three feet, quoted in the text, would be barely competent to a charge of 3,335,204 men. By throwing the gaseous contents, however, into a more elongated form, it would be possible, as we before observed, to reduce the resistance without affecting the buoyancy. Such a vessel would be a cylinder, capped with cones, or an ellipsoid, whose transverse axis was two thousand and fifty feet, and length equal to four times its diameter. The resistance occasioned by the direct *impact* of such a body in progress through the atmosphere at the rate of thirty-five miles an hour would, accordingly (as will be seen by reference to the preceding formula), be equal to 13,337,160,354 pounds, and 3,334,290, the number of men by which an equal amount of force could be generated; each man's quotum being eight pounds, as above assigned, and a double allowance of men being required to admit of the operation being carried on without interruption. The difference (amounting to nine hundred and fourteen) between the number of men equivalent to her resistance and that equivalent to her buoyancy, as here displayed in favour of the latter, however *less*, would certainly not be *more* than enough to compensate for the weight and resistance of the machinery, the friction of the atmosphere, and other circumstances, more or less influential, which have not been included in the above calculation.

brium is disturbed by the abstraction of a part of either of these resources a sacrifice of a proportionate amount of the other becomes absolutely necessary in order to restore it; a proceeding, it is scarcely necessary to remark, by which her whole efficiency must sooner or later become destroyed. This objection equally applies to all those powers which are obtained by means of chemical decomposition, the rapid generation of gases by explosion, combustion, or otherwise—the very efficiency of which is, in fact, only commensurate with the loss of weight by which they are accompanied; nor am I aware of any principle whatever applicable to the purposes in question, unless, indeed, it may be that of electro-magnetism, concerning which, however, our information is yet too limited to allow us to speak more decidedly.

( IV. )

Possessed of these, the mechanical agents of the propulsion, together with a power sufficient to invest them with motion at the rate and under the development of pressure before calculated, the aerial engineer must not conclude that the question of the guidance of the balloon has been completely solved, and that nothing remains to interfere with its immediate adoption as a mode of transport applicable to the ordinary purposes of life.

Independent of the difficulty that must ever attend the reduction to practice of rules involving the nicest points in rational and practical mechanics, the most rigorous economy of power, and an intimate knowledge of the strength of materials, with the best method of employing them, there are certain restrictions regarding their application, failing compliance with which the best-devised schemes for the propulsion of the balloon must prove utterly inefficacious, or at least successful to so small an extent as to remain still as inapplicable as ever to the purposes for which they are required.

The first of these regards the form of the aerial vessel. It is scarcely necessary to observe, that before any scheme for its guidance be attempted, the balloon itself must be of such a form as will admit of its being guided. It must have a line of least resistance, and this line must be that in the direction in which it advances. This involves, likewise, the consideration of a rudder, or some other corresponding apparatus, by means of which its propulsive energies may be directed into a determined channel. In short, it must have a head and a tail, as well as a body, and be capable of assuming and maintaining a fixed position during its forced progress through the air. Such a form, for instance, would be that of an ellipsoid, as before observed, or a cylinder terminated by cones, like that recently exhibited to the public by Count Lennox, under the name of the Aerial Ship, and of which representations are to be found in old prints of aerostation, illustrative of previous projects for the guidance of the balloon.

In the second place, it must be so contrived that when subjected to the action of a strong current of air, the balloon shall not, in the change of position it will be inevitably forced to adopt, interfere with the action of the machinery by which it is impelled. In regard of this, as indeed of all the other rules, consideration must be had, not to the *actual* shape and position of the balloon, but to that which it will have assumed when acting under the influence of the opposing forces.

Thirdly, it follows from this, as a matter of course, that the same strength of materials which is found sufficient for an ordinary balloon would by no means suffice for one the nature of whose employment infers the exposure to excessive and unwonted opposition.*

Fourthly, the whole must be so constructed as not to suffer from the shocks to which it will be unavoidably subjected whenever it comes into contact with the ground, owing to the impossibility of making the attachment to the earth with that degree of firmness and certainty which is necessary to ensure the safety of the balloon and place it under the immediate control of the aeronaut. And this, it strikes me, is one of (if not actually) the most important of the practical restrictions in question, and, at the same time, the most difficult to be complied with consistently with the other essential features of the case. For what, after all, can be the merit of any machinery that is liable, nay, almost certain, to be rendered valueless whenever it may happen to be employed, except under such a favourable juncture of circumstances as is not to be counted upon in the practice of an art carried on under the auspices of proverbially the most fickle power in nature? And yet I must confess I do not see

* Of the necessity for this provision the French projectors seem fully sensible, when they advert to the possibility of forming the balloon itself of solid materials, and gravely look forward to the time when wood, copper, iron, and the other ingredients of terrestrial and marine architecture, shall be put in requisition to supply a more substantial vehicle for the occupation of the empty regions of the sky. Upon the practicability of such schemes, it would be useless to waste words; I should only like to know, when formed, how it is to be inflated, and when inflated how it is to be emptied; for it is not to be forgotten that before it can be inflated it must first be emptied, while, at the same time, once it is filled, nothing can be abstracted from it without the introduction of an equivalent. This latter consideration would, I rather suspect, leave the office of the valve somewhat in the nature of a sinecure.

any means of avoiding this conclusion by any structure of machinery that shall be in accordance with the rules we have before laid down for its regulation. The great extent of surface, and the lightness which ought to be its primary characteristic, are qualities equally calculated to aggravate the effects of the opposing forces, as incompatible with the requisitions of strength by which alone they could be successfully resisted; and, indeed, it is difficult to conceive any structure or arrangement of machinery suitable to the purpose, that shall either be beyond the reach of the violence to be apprehended, or sufficiently strong to avoid suffering essential detriment from it whenever it occurs.*

Fifthly, the agents of the propulsion must be made to operate directly upon the body of the balloon itself, and not, as in every scheme heretofore projected, upon the car which is attached to it.† In the fulfilment of this condition a great difficulty presents itself in the different nature of the materials which will have to be employed in the construction of the balloon and of its machinery; the flexible quality of the one, the solid unyielding nature of the other, and the certain danger to the former when united firmly to the latter under exposure to forces such as may be expected to accompany the operation of aerial propulsion.

Sixthly, the construction of the machinery must be such that an injury to one part shall not necessarily impede or prevent the action of the rest, or be attended with consequences involving the *security* of the balloon.

And lastly, though not least, the whole must be so contrived as to maintain its equilibrium under all the variations of force to which it will be inevitably subjected in its progress.

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These, then, constitute the principal obligations which the nature of the proceeding has imposed upon the guidance of the balloon. From a consideration of what has been discussed in the preceding sections, the ingenious reader will, no doubt, have observed that the main obstacles to the accomplishment of the object in view are, first, the construction of surfaces of the proper degree of lightness, and of sufficient size and strength united, to enable them at once to *effectuate* and *withstand* the pressure they are required to afford; secondly, the adaptation of a power competent to invest them with the proper motion; and thirdly, the arrangement of the whole machine in accordance with the principles laid down in the latter section.

A fourth obligation, however, of equal, if not superior, importance to any, yet remains to be commented upon; namely, the regulation of the motive agents in such a manner as to ensure by their impact the resistance which has been assigned to their operation. The difficulty of complying with this requisition is one proceeding from the elastic nature of the medium, whereby its equilibrium of density becomes more easily disturbed, and a state of rarefaction induced in the portions contiguous to the surfaces in question, to the manifest deterioration of the resistance they are expected to create. This will be better understood when we consider that upon the rapid passage of the surfaces in question a large portion of the adjacent atmosphere is swept away in the direction of their impact, leaving throughout their whole course a medium more or less rarefied in proportion to the rapidity with which they operate. To this result both the rate and size of the moving planes essentially contribute; and there is no doubt that long before either of these conditions were fulfilled to the extent assigned in the estimate of their respective quantities, a considerable approximation to a vacuum would have been formed in the locus of their

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* The disregard of this particular constitutes one of the most remarkable characteristics of all the aerial projectors with whom I have ever communicated. Treating the balloon merely as a mannequin, to *try on* schemes of propulsion, they entirely neglect to consider the condition it will be placed in when it comes to be exposed to the influence of the forces it will have developed in its career. Hence the inefficacy and absurdity of most of their contrivances whenever any attempt has been made to reduce them to practice. One of the adjuncts to the original plan of Count Lennox's air-ship was, I remember, a set of small wheels fastened beneath the car (or rather the canoe), to the frame of which the motive agents were to be appended, in order to enable it to glide on the earth after the descent, and avoid the consequences of a too sudden interruption to its flight! Imagine a piece of machinery sixty feet broad and one hundred and eighty long, bearing a charge of more than ten tons, and furnished with wings projecting some forty feet or more on either side, gliding over the country upon castors, under the influence of a wind moving at the rate of thirty or forty miles an hour, attached, *for steadiness*, to a vessel of still more preposterous dimensions, floating overhead and exposing to the action of the wind an extent of surface equivalent to upwards of twenty thousand square feet! Indeed the speculative Frenchman seems to have entertained a strange notion of the nature of the element with which he was about to contend, when, in reply to the suggestion of a gentleman concerning the security of his machinery in the descent, he observed that it would be easy to obviate all danger upon that score by coming down under the lee of some building or high wall, by which he would at all times be sure of being properly sheltered from the wind!—an ingenious expedient, as Mr. Green slily observed, which might be considerably improved upon by the addition to his cargo of a *ready-made north-wall*, suited to all cases of emergency; upon the principle, no doubt, of the *universal finger-post* which the Irishman sagaciously proposed to the celebrated African traveller, Captain Clapperton, as a ready means of solving his doubts whenever he should happen to have the misfortune of losing his way in the deserts!

† See Note C, by M. Monge, at end of this paper, p. 334.

operations, requiring more or less time to fill up, in proportion to the extent of space it had effected. Now, should it happen that the planes in question be compelled to reiterate their percussion within the sphere of this disturbance ere the atmosphere has had time to recover from its effects, a drawback to their efficiency will be occasioned which no increase of rate or dimension will enable them entirely to overcome.

Upon the whole review of the case, then, it must be avowed that the propulsion of the balloon to the extent we have imposed upon it is beset with difficulties of no ordinary description. It is true that these difficulties consist not so much in the *quality* as in the *quantity* of what is sought to be done—in the *nature* of the operation, as in the *extent* to which it is requisite that it should be accomplished. Hence the possibility of effecting in a minor degree that to which considerations of paramount importance have induced us to assign a more extended limit. Apart from other considerations, the question of the guidance of the balloon is a mere expression, conveying no definite idea and affording no certain grounds for investigation. As a mere abstract fact, there is no doubt the balloon can be guided; it is only in reference to the particulars of the case that any question can arise upon the matter. When, therefore, any person says that he has discovered the means of guiding the balloon, his assertion literally amounts to nothing, unless, at the same time, it be coupled with a specification of the rate and conditions under which he is able to effect it. Should these be found to correspond with what has been stated in the preceding sections, then, and not otherwise, will the question of an aerial navigation, applicable to useful purposes, have been duly and satisfactorily determined. This, however, is a consummation which I fear there is but little prospect of our ever being able to attain. The deficiency of power and the limitation assigned by nature to the strength of materials form a barrier which all our efforts seem incapable of enabling us to surmount; and, indeed, when we consider the nature and amount of the forces required to the propulsion of the balloon, it becomes a matter of question whether the same exertions would not be sufficient to enable us to dispense with its services altogether, and transport ourselves through the air by the simple exercise of wings alone.*

The reader must not be misled by those insidious analogies by which unreflecting persons are wont to be guided in their sentiments upon matters of this description; nor conclude that, because a ship sails, a fish swims, or a bird flies, it is equally consistent with the laws of nature that a man should be able to direct his course through the atmosphere by the aid of a balloon. Ample reasons will be found in the circumstances of each to invalidate these analogies and disprove any dependence which might be conceived to exist between them. The ship commands her course over the bosom of the ocean, not from the simple fact alone of her possessing two elements endowed with different rates and inclinations of motion (for such a reason would exclude the steam-vessel from our argument, which secures her progress by the instrumentality of one alone), but also from the striking superiority in the density of that (the water) to which she resorts for her propulsion over that (the air) in which so large a proportion of her mass is destined to move;† while, at the same time, the general condition of the former, as far as its progressive motion is concerned, is such as to require but a comparatively moderate share of power to enable her to contend with it. Of these, the latter is an advantage equally enjoyed by the finny inhabitants of the deep; and though it is true the former (namely, a difference of density in favour of the medium of propulsion) does not characterise their condition any more than it does that of the balloon, yet the want of it is more than compensated by the possession of a specific gravity, so nearly on a par with that of the element in which they move, that little or no accession of bulk is required to enable them to support themselves that does not likewise contribute to the enhancement of the strength by which they direct their motions. The example of the bird, it is true, appears at first sight to be more to the point: possessed as it is of a specific gravity scarcely more favourable to its support than our own; while, at the same time, the medium of its evolutions being the same as that of the balloon,

* The reader may not perhaps be aware that the bold idea of human flight has once to a certain extent been actually realised, and that one individual, almost within the memory of man, has been known to raise and conduct himself through the air by the agency of wings alone. The instance alluded to is that of the Marquis de Bacqueville, who in the year 1742, according to a notification which he had made to that effect, rose in the sight of the assembled multitudes of Paris, from his own residence on the *Quai des Théatins*, and directed his course across the Seine towards the gardens of the Tuileries, whither he had signified his intention of proceeding. At first he appeared to advance with tolerable steadiness and facility; when about halfway over, however, something occurred which has never been thoroughly comprehended, by which he seems to have been deprived of the power of continuing his exertions; when, his wings ceasing to act in the manner necessary for his support, he sank to the ground and was precipitated against one of the floating machines belonging to the Parisian laundresses, which line the arches of the *Pont Royale* on the side of the river opposite to that from which he had taken his departure, whereby his leg was broke and other serious injuries inflicted upon his person.

† A reference to the operation of the motive agents will show that the very reverse of this is the relative condition of the medium of propulsion and that of opposition, in the case of the balloon.

the same impediments remain to be encountered by them both. The analogy, however, although certainly more specious than the preceding, is by no means more conclusive. For both these emergencies Nature has supplied a remedy; for the former, in the endowment of immense muscular strength; for the latter, in the *actual* smallness of their dimensions. Possessed of a power sufficient of itself to overcome the attraction of gravitation, the efficiency of the animal is ever dependent upon its bulk, and consequently at all times proportioned to the resistance it has to contend with; while from the *positive* smallness of its size, not only does the structure of its organs easily fall within the limits assigned by Nature to the strength of the appropriate materials* (in consequence of which it is enabled to surmount a great portion of the forces arrayed against it, and at all events avoid incurring damage from the remainder), but likewise through the facility with which it can secure a retreat, it is enabled without prejudice to dispense with the possession of powers superior to what at times it may have occasion to encounter: confined to minute dimensions, the bird that is unable to match with the wind can at every turn find a refuge from its influence, and is consequently perfect with half the comparative amount of force which would be necessary to the success and security of the balloon. Thus, to sum up: a density in the opposing medium inferior to that of the medium of propulsion; a specific gravity but slightly removed from that of the element in which they move, together with comparatively trifling forces to contend with; and lastly, a size that arms them against injury and puts security at all times within their reach. These are advantages more or less enjoyed by all objects affecting fluid media which are denied by Nature to man in his endeavours to navigate the atmosphere, and completely destroy whatever analogy might be thought to exist between them.

"But," it may be asked, "supposing us unable to accomplish all that has been stated to be necessary to the perfect government of the sky, why may not an aerial navigation be made applicable to useful purposes in a *less* degree? And why must we abandon *all* hopes of advantage from the practice of an art because we are unable to bring it to a higher degree of perfection?" Simply because, in reducing the rate (upon which hinge all the essential difficulties of the case), we sacrifice altogether that condition by which the character of an art *applicable to useful purposes* is essentially distinguished, namely, the certain prospect of success. It is not that the object would be accomplished with less speed, less safety, or to a less extent; but that in adapting our resources to a scale of opposition inferior to what we may have to encounter we forego the *certainty* of ever accomplishing it at all. For all purposes, where this condition is a matter of indifference, an aerial navigation might, no doubt, be established; but as it is this "regard to the result" that, as I take it, constitutes the main difference between affairs of business and affairs of pleasure, still would the latter alone have all the benefit of our exertions.

## M. Marey Monge points out, in the four notes below, the chief errors of the preceding calculations, which, being in principle incorrect, make the whole erroneous.

*Note* A (*p.* 319), *by M. Monge.*—Newton demonstrated the law "That the resistance of fluids was in proportion to their density." To speak, therefore, of the rate of motion of two fluids (water and air), without taking notice of their density, is to say nothing relative to the force necessary to resist them.

In fact, supposing 1 cubic mètre of sea-water having the velocity of 16 kilomètres an hour, and 1 cubic mètre of air having the velocity of 160 kilomètres an hour, let us see what force will be required to resist these two cubic mètres. Let 1 be the weight of a cubic mètre of air; that of a cubic mètre of salt-water will be 804; and the force necessary to resist the fluids shall be equal and contrary to the movement in each: that is to say, for air, $1 \times 160 = 160$, and for water $804 \times 16 = 12864$; or $::\ 1\ :\ 80$. *Hence it will be* 80 *times easier to resist, with an equal volume, the highest winds than the strongest waves;* or else, in the air, a surface 80 times larger than another in the sea

* Even if a man were endowed with the same proportion of muscular strength as a bird, with the same natural organisation to enable him to apply it, he could not, for the reason here mentioned, ever turn it to the same account; inasmuch as, with all his powers to fly, he could never procure material that would admit of sufficient extension to construct the organs of his flight. Hence, man, though he may succeed to a certain extent, as in the case of the Marquis of Bacqueville, will never be able to dispute with the feathered tribes the empire of the sky; not because he could not *exercise* his wings, but because he could not *make* them. Of the limitation thus imposed by Nature, the strongest and most striking examples are afforded in the works of Nature herself: when the birds of *her* creation exceed a certain size they do not fly. It is not because they are heavier in proportion to the density of the medium, and therefore want the requisite degree of muscular strength; for that *is* in many cases, and *could* in all, be supplied by Nature without any infraction of her existing laws: it is because Providence has not thought proper to create a material adequate to the construction of their organs. The emu, the cassowary, the dodo, the ostrich, are birds in all but the possession of wings; may we not conclude that, if the materials for their construction had already existed, Nature would not have left the noblest specimens of her work imperfect? And, can man hope to succeed, where Nature has declared her inability to prevail?

See Note D, by M. Monge, at the end of this paper, page 334.

will be equally able to resist the highest winds as the other to resist the strongest waves. This conclusion is opposite to Mr. Monck Mason's. But let us further remark—

1st. That the aerostat can always, in case of high winds, change its altitude, and can find a layer of air calm or more favourable. Mr. Monck Mason has lost sight of this when he says, "a balloon might reach the antipodes *ere any circumstances* might have occurred to favour the recovery of her course."

2nd. A wind that moves 160 kilomètres an hour is a hurricane that levels buildings; whilst in fact the aeronaut has only to deal with wind that moves at an average rate of 40 kilomètres an hour. According to the above formula, we shall find that the rate of movement of a cubic mètre will be, for the air, $1 \times 40 = 40$; and for water, $804 \times 16 = 12864$ or $:: 1 : 321{\cdot}6$. Hence an aerostat with a section surface 321·6 times larger than the section of an ocean-steamer would not require more power to move against an atmospheric current of 40 kilomètres the hour than is required by a steamer to overcome waves moving 16 kilomètres the hour.

*Note* B (*p.* 320), *by M. Monge.*—What, then, is the motive principle in a steamer without sails? It can tack and steer without the help of the wind. Let us recapitulate in a few words the elementary principle of navigation. It is, that for navigating, tacking, &c.—in a word, that the power of the helm should be felt—two elements are necessary: water and the moving power. It matters little whether the latter comes from without, as the wind, or from within, as is the case with steam, for the helm to take effect; so long as it puts the ship in motion it is all that is required. Nothing is easier to verify. Take a boat with two rowers, hold the rudder in your hand; if the rowers do not pull, you move with the current and it is useless to steer; but, as soon as they pull, you can give it the direction you wish. Hence, "*the helm can only be effective when the motive power is in action.*" (A note states that the writer is mindful of a long helm, used on rivers, which he shows to depend on other principles.) Now this principle is applicable to an aerostat provided with a helm and carrying a motive power (steam or any other). Hence, *in using the motive power and the helm at the same time an aerostat can be guided*, and this upsets the objection given above.

INTERIOR OF THE NAUTILUS.

In acquiring the camerated structure of the shell, the embryo Nautilus gains the power of rising from the bottom, and the requisite conditions for swimming; by the exhalation of some light gas into the deserted chambers, it attaches to its otherwise too heavy body a contrivance for ascending in its atmosphere, as we ascend in ours by the aid of a balloon. But the Nautilus, superior to the human aeronaut, combines with the power of elevating and suspending itself in the aqueous medium, that of opposing its currents, and propelling itself at will in any direction. It possesses the latter essential adjunct to the utility of the balloon as a locomotive organ, by virtue of the muscular funnel, through which it ejects into the surrounding water, doubtless with force, the respiratory currents.

It appears that the proportion of air-chambers to the dwelling-chamber of the Nautilus and its contents is such as to render it of nearly the same specific gravity as the surrounding water. The siphon, which traverses the air-chambers, communicates with the pericardium, and is most probably filled with fluid from that cavity. It certainly conducts small blood-vessels, which are essential to the vitality of the chambered part of the shell.—OWEN'S *Memoir on the Pearly Nautilus.*

*Note* C (*p.* 330), *by M. Monge.*—No; it will pass through the centre of gravity of the *whole* machine. This will probably be found below the gasholder, on account of the weight of the car and its contents; and this position of the centre of gravity below "the body of the balloon itself" will be very favourable to the agency of an axle and to the uniform movement of the whole, because it will be put in motion from the centre of gravity.

*Note* D (*p.* 332), *by M. Monge.*—We must not forget that there is no analogy between birds and aerostats. Whilst the latter are supported by enclosed gas, the former require wings to sustain as well as move themselves along. Besides, there are instances in which we must cease to imitate Nature. . . . . *We may venture to assert that neither opinions based on calculation, nor the laws of Nature, indicate the impossibility of aerial propulsion.* The marine navigation had difficulties as great in its youth; and, far from renouncing the hope of overcoming the obstacles to aerial navigation, let us rather remember the ancient adage, "Labor improbus omnia vincit."

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It is with the greatest pleasure that we now come to the valuable 'Études sur l'Aérostation,' by Mons. Marey Monge, published in 1847; and to his careful calculations would I refer any one who desires a deeper insight into this science. We have already given his corrections of Monck Mason's observations; suffice it here to insert his synopsis of the difficulties to be overcome, and an abstract of the book from the "*rapport*" made of it in 1849, to the "Société d'Encouragement pour l'Industrie Nationale."

He approaches the sciences by saying aerostation is divided into two parts:—

1st. Aerostation as it now is, in the infancy of the art, may serve for scientific and military observations, for aerial voyages without direction, for public fêtes, for lightning-conductors and hail-preservers.

2nd. Aerostation, as it will be, which constitutes aeronautics, that is, aerostation taken in the largest acceptance of the word;—in the hypothesis of an aerial navigation, capable of rendering the same services as marine navigation.

The first is far yet from being a safe and certain means, notwithstanding the numerous experiments already made, and requires many improvements.

The second is hardly broached in theory, and in practice has to be created.

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M. Monge's synopsis of the difficulties to aerial navigation, showing what conditions must be fulfilled, and the researches it is necessary to make, is as follows:—

| The Conditions to fulfil. | Observations. | Researches to make. |
|---|---|---|
| *1st Condition.*<br>What the gas-holder is to contain. | We are decided on the nature of the gas, it is hydrogen. | Find a process of making it more cheaply than by sulphate of zinc or of iron.<br>See if it cannot be obtained more quickly and economically by the decomposition of water by some untried way. |
| *2nd Condition.*<br>Of the material used for constructing the gas-holder. | Silk, cotton and skins are substances insufficient to make it impermeable. Metals are a great expense, as they must be of such thinness as to allow of sheets overlaying each other.<br>Anyhow, it appears indispensable to employ material less flexible and more resisting than what is used at present. | Consider pasteboard, composed of many sheets of paper carefully joined and varnished, so as to make it proof against the escape of the hydrogen. |

| The Conditions to fulfil. | Observations. | Researches to make. |
|---|---|---|
| *3rd Condition.*<br>Of the form of the gas-holder. | The directing and the management of a captive aerostat demands a lengthened form; with pressure from the interior; the construction of an aerostat of large dimensions would require a cylindro-conical surface. | Build a cylindro-conical aerostat and find out the just proportion between the greater and the smaller axis. Meusnier proposes that the greater axis should be two or three times that of the smaller axis,—might it be four times? |
| *4th Condition.*<br>The aerostat must have some internal pressure, so that it should not be indented by the resistance of the air, when it shall navigate in mid atmosphere, or to resist the wind when it shall be captive or at anchor. | This condition is indispensable, and appears the one most discussed; it is perhaps the shoal of aerial navigation. The pressure ought to be very little, less than $0{\cdot}002^{m}$ in large aerostats. | Try the cylindro-conical aerostat provided with the two condensers that I have proposed. Find out the laws of the resistance of the air by experiments made with a view to aerostation.<br>Would not the resistance of the air augmenting the internal pressure (which ought to be very little) burst the aerostat? or would it not limit its speed? |
| *5th Condition.*<br>The aerostat ought to ascend and descend without loss of gas. | Of all methods hitherto proposed none are perfectly good or sufficiently energetic: it will be necessary to use several simultaneously, viz. the addition of a Montgolfière, the two condensers, the guide-rope, mechanical means, screws, "roues à palettes," and the variation of the atmospheric temperature. | Try the addition of a Montgolfière, the two condensers and the mechanical agents, as the means of ascent and descent without loss of gas. |
| *6th Condition.*<br>The aerostat ought to be provided with a motive power sufficient for it to progress, by means of its own locomotive powers. | We have shown that the adaption of steam-engines to large aerostats is not impossible. | As soon as aerostats of large dimensions are constructed, it will be necessary to try steam-engines and other appliances for motive-power. |
| *7th Condition.*<br>The aerostat ought to have a helm. | It is probable that a moveable weight in the longer axis of the aerostat will curtail the use of the helm to a vertical oscillation similar to its use in ships. | Make trial of the proposed model, or any other. |
| *8th Condition.*<br>The aerostat must have nothing to fear from strong winds when it is captive or at anchor. | This condition is of vital importance to aerostation. Everything tends to the belief that this can be effected by sustaining-cords. | Make trial of the proposed model, or any other. |
| *9th Condition.*<br>The aerostat of large dimensions must be of a simple construction. | The adoption of a gas-holder with little flexibility necessitates the building of the aerostat without folding (a framework is not possible).<br>The surface extended in a flattened state would permit of its construction. | Try to build a cylindro-conical aerostat with its surface extended horizontally. |
| *10th Condition.*<br>The aerial navigation ought to offer advantages beyond those of the various means of locomotion hitherto used.<br>Examples of some of its applications. | The dangers will not be greater than on the sea, the speed will be that of the wind; all places will enjoy the advantages of the present seaports. Lading and unlading will be very easy.<br>Its appliance to science, to war, and to the hail disperser (paragrêle), is a subject full of interest. | Try the aerostat. |
| *11th Condition.*<br>To indicate the order that should be observed in future experiments, and the ways and means of meeting the expenses. | Aerostatic experiments made for the object of improving the science can only be undertaken by governments, or a society of rich capitalists. | To construct a cylindro-conical aerostat in pasteboard 10 metres in diameter, and 40 metres in length.<br>Afterwards another 20 metres in diameter, and 80 metres in length, &c. |

From what precedes, we may, I think, draw the following conclusions:—

1st. If the possibility of aerial navigation is not shown by experiment, neither is its impossibility demonstrated by mathematics. This impossibility, or rather the great difficulty, will come from the resistance of the air (see fourth condition), which, acting on the interior pressure, might burst the aerostat when it is propelled at a rapid rate.

2nd. Aerostation will not be useful nor important to mankind unless a material for the gas-holder, both impermeable to the gas, and unalterable to the resistance of the air, can be found, and large dimensions (such as 100 metres in diameter) be available.

3rd. An experiment on a large scale is necessary, and is worth more than figures, to decide this question in a satisfactory manner.

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The following are extracts from this work:—

It appears from the calculations we have just given, that to deny the possibility of aerial navigation, is to deny the law of Newton (the resistance of fluids is in proportion to their density), also to deny steam-navigation on water. It is, therefore, to deny two facts equally demonstrated, which is doubly absurd. Aerial navigation is therefore a possibility demonstrated by calculation.

* * * * * * * * * *

Again:—

From this we learn that before completing the science of "Aerial Navigation," several millions must be expended. It is evident that this sacrifice is beyond the means of private individuals; and, as it is a question for mankind, because it confers on society a new means of locomotion, more powerful, more rapid, and at the same time more economical than any other, it is therefore to be desired that one or several Governments, or else a Company with a large capital, should make experiments on a systematic plan, and not, as heretofore, to waste time and money in experiments without a system.

It would be still better if an EUROPEAN AERONAUTIC SOCIETY, *composed of representatives of all nations, were formed.*

The Society could vote an annual sum to be expended, and discuss the projects to be put in execution, giving thereby encouragement to those that advance the science with slow but sure steps.

The following is the Report of this work:—

RAPPORT FAIT PAR M. ALCAN, AU NOM DU COMITÉ DES ARTS MÉCANIQUES, SUR UN OUVRAGE INTITULÉ 'ÉTUDES SUR L'AEROSTATION,' PAR M. EDMOND MAREY-MONGE.

MESSIEURS,

La fin du dernier siècle, si féconde en découvertes importantes, n'en produisit aucune qui eut autant de retentissement que celle des aérostats. Avant 1783, époque des expériences étonnantes des frères *Montgolfier*, on disait *que la nature avait refusé à l'homme la faculté de s'élever dans les airs*, comme on répétait, un peu plus d'un siècle auparavant, *qu'elle avait horreur du vide;* et qui sait si les espérances de *Montgolfier*, confiées à l'avance, n'eussent été considérées comme chimériques par les illustres savants eux-mêmes, qui se sont servis plus tard, dans l'intérêt de la science, de sa mémorable découverte? Aussi l'enthousiasme causé à la vue des premières montgolfières fut-il aussi grand et aussi général que le doute, pour ne pas dire plus, avait été universel.

Tous les rangs de la société célébrèrent la victoire scientifique de *Montgolfier*, et ce serait le cas de dire, si nous ne craignions de faire un jeu de mots, qu'elle fut vraiment portée aux nues. Cet accueil fait à une invention est à signaler dans l'histoire des découvertes, qui n'a souvent, pour l'apparition des plus fécondes, que dédain et indifférence à enregistrer. Ce triomphe, peut-être unique dans les annales de la science, n'aveugla cependant pas *Montgolfier* sur la valeur de ses résultats: "Nous avons un instrument de plus, dit-il, il faut maintenant savoir s'en

servir." Les soixante-quatre années écoulées depuis ces paroles en ont démontré la vérité, puisque, aujourd'hui encore, on est à se demander: "Que faut-il attendre de l'aérostation? Cette magnifique découverte, une des plus glorieuses de l'esprit humain, doit-elle rester stérile? La navigation aérienne est-elle une chimère ou non?"

Telles sont, en effet, les questions que s'est posées M. *E. Marey-Monge*, et qui ont donné naissance au livre intéressant dont nous avons à vous rendre compte succinctement.

L'auteur a divisé son travail en trois parties: la première, comprenant *les diverses conditions de la navigation aérienne;* la seconde, *la construction d'un ballon en cuivre;* et la troisième, *des notes complémentaires qui se rattachent aux deux premières.*

M. *Monge* distingue dans la navigation aérienne: 1° l'*aérostation actuelle*, ou l'enfance de l'art, qui est loin encore d'être un instrument docile sans imperfection, et dont l'usage est restreint aux observations scientifiques et militaires, aux voyages aériens sans direction, aux fêtes publiques, aux paratonnerres, paragrêles, etc.; 2° l'*aérostation à venir*, dont la théorie est à peine ébauchée, qui laisse tout à faire en pratique, et qui devrait, un jour, rendre le même service que la marine. Il y a, pour les deux cas, des considérations principales et communes, à l'étude desquelles l'auteur s'est livré avec soin. Le contenu de l'aérostat, son enveloppe, sa forme, les moyens de le diriger ont été successivement soumis à ses recherches. Il passe en revue, comme contenu, l'air chaud, la vapeur, l'air raréfié et l'hydrogène; il démontre la supériorité de l'emploi de ce gaz sur les autres moyens, et qu'il ne laisserait plus rien à désirer, si l'on parvenait à tirer un meilleur parti des sulfates de fer et de zinc provenant de sa préparation, ou si l'on pouvait l'obtenir par une décomposition plus prompte de l'eau. La chimie ne saurait laisser longtemps cette question pratique sans solution.

L'enveloppe des aérostats, qui, comme le fait remarquer l'auteur, doit être complétement imperméable, inaltérable aux intempéries des saisons, et d'une certaine ténacité, est une des parties laissant le plus à désirer, quoique des plus essentielles. Un aérostat à enveloppe défectueuse équivaudrait, en effet, à une barque qui ne tiendrait pas à l'eau, et cependant aucune matière des trois règnes n'offre toutes les conditions propres à une bonne enveloppe. Aussi M. *Monge* fait-il remarquer que les *premiers pas, en aérostation*, sont arrêtés par cette difficulté que l'expérience seule peut trancher.

En abordant l'étude de la direction, M. *Monge* commence à faire justice de l'idée trop généralement admise, qu'il n'y a pas de point d'appui dans l'air, et que l'on ne peut aller contre le vent. Ses arguments sont basés sur des exemples pratiques fournis par quelques tentatives heureuses de direction, sur une comparaison ingénieuse et vraie entre les analogies et les différences qu'offrent la navigation maritime et celle aérienne, enfin sur des démonstrations géométriques et des calculs positifs. Cependant, en admettant que les couches atmosphériques aient une résistance suffisante pour fournir des points d'appui, l'auteur ne manque pas de signaler leur faible densité, qui est de 804 moindre que celle de l'eau: les surfaces qui y sont plongées, comparées à celles immergées dans l'eau, doivent donc augmenter dans le même rapport; et, pour démontrer que les poids résultant des grandes surfaces relatives ne sont pas un obstacle dans l'aérostation, il rappelle, d'après *Newton, que la résistance des fluides est proportionnelle au carré des diamètres et des vitesses.* Or la force ascensionnelle d'un ballon, croissant comme son cube, pourrait prendre une valeur telle, qu'elle soulèverait un poids quelconque, et enlèverait, par conséquent, un moteur dont on se servirait pour diriger l'aérostat, une fois qu'il serait arrivé dans la région la plus convenable du vent.

On trouvera, dans le livre, des calculs très-clairs et très-précis à ce sujet. Sans admettre précisément qu'un aérostat puisse aller contre un vent quelconque, l'auteur pense qu'à l'aide d'une force suffisante il pourrait se diriger contre un courant léger, comme un bateau marche contre le cours d'une rivière. Il va plus loin: "Il n'est pas absurde, dit-il, d'admettre la possibilité d'un aérostat colossal, porteur d'une machine tellement puissante, qu'elle soit capable de vaincre la résistance des vents forts, et qui, semblable à nos énormes paquebots transatlantiques de 5 à 600 chevaux, partirait à son heure fixée (sans s'inquiéter de la force ni de la direction du vent), avec une vitesse minime à la remonte, pour aller gagner des couches supérieures, où le calme et les vents favorables lui permettraient de faire usage de toute la puissance des machines." On voit que l'auteur ne réserve aux moteurs qu'un rôle secondaire dans la navigation aérienne. Ils seraient destinés à être remorqués, pour ainsi dire, pour ne servir que comme gouvernails à certains moments. Cette supposition, qu'une partie de la quantité d'action, dont il faut être si avare surtout dans la circonstance dont il s'agit, sera absorbée par le poids considérable d'un moteur, ne devant servir que par intermittence, ne peut satisfaire complétement les idées mécaniques. La réalisation d'un moteur puissant, sous un faible poids, peut donner bien plus d'espérances, et n'est pas plus hardie que l'emploi de ces ballons gigantesques, encore si défectueux. La difficulté de la création d'un moteur semblable vient d'ailleurs s'amoindrir, lorsqu'on

réfléchit que la question de la dépense est secondaire dans la solution du problème; car cette dépense serait largement compensée par l'économie à faire sur la construction de la voie qui se trouve tout établie avec la même perfection autour de tous les points du globe.

Après avoir fait comprendre toute la portée de son sujet, l'auteur revient en détail sur les différentes parties essentielles, telles que la *forme la plus convenable à adopter* pour les grands aérostats destinés à la navigation à tous vents; *la pression intérieure qu'il ne faudra pas dépasser;* les principaux moyens usités pour *monter et descendre sans perdre de gaz.* Notre cadre ne nous permettant pas de suivre les développements de tous ces points, nous nous bornerons à relater quelques-uns des résultats consignés.

Comme la pression intérieure d'un aérostat doit être très-faible pour ne pas déchirer l'enveloppe, l'auteur démontre que la forme la plus convenable à adopter est la surface développable cylindro-conique, qui peut se prêter à l'action de compresseurs sans exposer l'étoffe à une rupture, propriété que n'a pas l'enveloppe à double courbure, qui est, par conséquent, exposée à des plis nuisibles, lorsque la pression sur certains points varie, comme cela arrive fréquemment.

Si l'on parvenait à faire un usage fréquent des aérostats à grandes dimensions, tout le monde comprend qu'on ne pourrait employer, pour monter et redescendre, des moyens dont on se sert dans les ascensions qui n'ont qu'un but de curiosité, consistant dans une perte de gaz qu'on laisse échapper par la partie inférieure du ballon lorsqu'on veut monter, et par celle supérieure pour pouvoir descendre. Ces pertes, dans un grand ballon, et pour un trajet d'une longueur sensible, diminueraient bientôt son action, et pourraient le mettre hors de service; aussi a-t-on proposé diverses dispositions pour éviteur ces fâcheux dégagements du fluide. L'auteur, après les avoir passées en revue, remarque qu'aucune, en particulier, ne peut agir avec l'énergie de la perte de gaz, et qu'il faudrait, dans l'état actuel de l'art aérostatique, avoir recours à leur emploi simultané, qui, malheureusement, est loin d'avoir la simplicité désirable. Mais, en attendant les nombreuses modifications que réclame l'art de la navigation aérienne, dans l'acception la plus large du mot, M. *Monge* s'occupe des perfectionnements que nécessitent encore les aérostats destinés aux observations scientifiques; il recherche les moyens de construire des ballons captifs, de façon à pouvoir les élever et les maintenir dans les airs au milieu de la tempête, ce que l'on n'a pu obtenir jusqu'ici. Il propose, en conséquence, une construction de ballons de forme allongée, et, pour qu'ils ne soient ni redressés verticalement ni abattus par un coup de vent, il combine un système d'amarre aussi simple qu'ingénieux. En un certain point de la corde de l'ancre qui maintient le ballon dans une position horizontale, il fixe une poulie sur laquelle passe aussi une corde ou soustendante, dont une des extrémités est fixée au-dessous et à l'arrière du ballon, et l'autre à l'intérieur de la nacelle. L'action du vent, en agissant à l'arrière du ballon, opérera comme sur un cerf-volant et le fera remonter. L'inspection de la figure tracée dans les planches du livre suffit pour se rendre compte de cet effet. M. *Transon*, dans un travail remarquable, addressé à la Société philomathique, avait déjà proposé, dans le même but, l'accouplement du cerf-volant au ballon. Mais la première idée que le cerf-volant pourrait un jour être destiné à un rôle moins futile que celui auquel il sert est due à *Euler* fils, qui publia, à ce sujet, de savantes recherches dans les *Mémoires de l'Académie de Berlin* de 1765.

L'application de la belle idée de M. *Arago* sur les aérostats paratonnerres et paragrêles dépendant d'une bonne enveloppe et d'un moyen de maintenir les ballons contre le vent, nous n'avons pu passer sous silence les recherches à ce sujet, car la réalisation de ces paragrêles serait, à elle seule, une compensation aux nombreux sacrifices faits pour l'aérostation depuis l'apparition des montgolfières.

Par la publication de la duxième partie de son livre, M. *Monge* donne une preuve rare de son amour pour le progrès. Cette partie est consacrée aux détails de construction d'un ballon en cuivre que l'auteur a fait faire, et qu'il recommande de ne pas renouveler à cause de son peu de succès, les métaux, sous une faible épaisseur, présentant trop peu de résistance, et leur emploi entraînant à une grande dépense. On doit donc savoir gré à M. *Monge* de chercher à éviter à d'autres des essais dans une direction pouvant entraîner à de nombreux frais en pure perte.

Enfin la troisième partie de l'ouvrage contient des recherches et des notes historiques intéressantes, des formules sur l'aérostation, des Tables diverses nécessaires à l'aéronaute, une étude sur l'accouplement des cerfs-volants aux ballons; des observations sur les poissons, les oiseaux, les insectes ailés, dans leur rapport avec les aérostats, etc. On voit que l'auteur n'a rien négligé pour rendre la publication aussi complète que possible; aussi peut-on la considérer comme un véritable traité élémentaire sur l'aérostation, pouvant être consulté avec fruit par toutes les personnes que cette grande question intéresse. Elles se convaincront que, si le problème de la navigation aérienne offre encore des difficultés énormes, les conditions, du moins, en sont nettement posées, et, ne présentant pas

d'impossibilité absolue, leur solution ne doit plus être qu'une question de temps. Il nous est donc permis de conserver encore l'espoir que semblaient renfermer les paroles de *Franklin*, qui a dit, à l'apparition des montgolfières, "c'est l'enfant qui vient de naître." En effet, en voyant avec quelle activité, à notre époque caractérisée cependant par ses recherches positives, on recommence à s'occuper d'aérostation, de perfectionnements pratiques, on est porté à croire que le terme de cette enfance n'est pas très-éloigné, et que, si la réussite complète de la navigation aérienne n'est pas réservée à notre temps, il pourrait lui être donné de la perfectionner suffisamment pour lui faire rendre bientôt des services signalés; mais, comme le fait observer M. *Monge*, le succès de tels projets ne peut être hâté qu'avec le secours des gouvernements et d'une association de capitalistes. Remarquons, à notre tour, que des travaux aussi sérieux que les *Études sur l'Aérostation* ne peuvent que contribuer à cet heureux concours. Ces études nous ont donc paru aussi utiles qu'intéressantes, et dignes, tant par leur nature que par la manière dont elles sont présentées, du nom illustre que porte l'auteur.

Votre comité des arts mécaniques vous propose, en conséquence, de témoigner votre satisfaction à M. *Monge*, en le remerciant de sa communication, et d'insérer le présent Rapport dans le *Bulletin*.

(*Signé*) ALCAN, Rapporteur.

Approuvé en séance, le 20 Juin, 1849.

We may sum up by saying, the weight of the air is the only base of aerostatic movement, and this weight is not far from being invariable. Mons. Nadar expresses this still more boldly in 1863 in the following formula:—

> "To contend against the air, one must be specifically heavier than the air.
> All that is not absurd is possible;
> All that is possible may be accomplished."

He then goes on to say:—

That which for the last eighty years has prevented the possibility of directing the course of balloons, is the balloon itself; in other terms, it is sheer folly to endeavour to struggle against the air, when one is lighter than the air. To the pen, *levior vento*, if the physicist may use the words of the poet, it is all very well to adjust and adopt all the various systems, however ingenious they may be—riggings, paddles, wings, fins, wheels, rudders, oars, helms, sails, and countersails—but it will never be able to prevent the wind from sweeping away the whole concern.

A balloon which presents to the action of the atmosphere a volume of from 600 to 1200 cubic metres (22,000 to 42,000 cubic feet) of a gas from ten to fifteen times lighter than air, is by its very nature smitten with incapacity to struggle against the slightest current, no matter what may be the resisting motive force which may be imparted to it. Both by its constitution and by the medium which drives it hither and thither at the pleasure of the wind, it can never become a vessel: it is a buoy, and remains a buoy.

The simplest mathematical demonstration will irrefragably show, not merely the helplessness of the balloon against the pressure of the wind, but that it is a positive nuisance, so far as regards aerial navigation. Given, on one hand, the actual weight which each cubic metre of gas is capable of lifting, together with the cubic contents of your balloon, and on the other the minimum pressure which the wind must exercise, calculate the difference, and then draw your own conclusions.

In short, it is necessary to bear in mind that whatever be the form which you give to your aerostat—be it spherical, conical, cylindrical, or a plane surface—make of it if you please a bullet-shaped body or a fish-shaped—however you may distribute the ascensional power in one, two, or four spheres—in a word, with whatsoever equipment you may provide it—you will never succeed in making 1 = 20, let us say; and balloons will never be other than pads are to a baby's head.

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The first thing which it is necessary to understand and to affirm is, that those partial successes, obtained in the absence of *the* adversary—in other words, during a dead calm, in an enclosed space—have proved nothing, since it is simply impossible they could prove anything.

Aerial locomotion must be proved *sub sole, sub Jove*, in the open air, and has nothing to do with fishes, nor chamber aeronauts. Yet it is owing to their indefatigable perseverance in failure that we are indebted for the establishment of a theory henceforth certain, since it emanates from themselves directly and absolutely by a negative.

We must, therefore, reverse the proposition itself, and formulate thus the new axiom: "In order to contend against the air, we must be specifically heavier than the air."

Just as the bird is heavier than the air in which it moves, so man must obtain from the air itself his support. In order to command the air, instead of being at its mercy, he must support himself upon the air, and no longer serve as support to the air.

In short, in aerial locomotion, as in everything else, we can only rest upon that which resists.

The air itself amply furnishes us with this resistance—the same atmosphere which overturns walls, tears up by the root trees a century old, and enables the ship to traverse the most impetuous current.

According to the common sense of things—for things have their common sense—according to physical laws, not less positive than moral laws, all the power of the air (supposed to be irresistible yesterday, when we could not stand before it),—all this power ceases to exist before the double law of dynamics and the gravity of bodies, and by this law it will come into our possession.

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This is not new, for in 1768 Paucton, the engineer, predicted for the screw its future importance in aerial locomotion. All we have to do is to give practical application to recognised phenomena. And, however alarming may be the simple appearance of an innovation, in France especially, it is our duty to hold fast to it, since if the majorities of to-morrow are merely the minority of yesterday, the paradox of yesterday is also the truth of to-morrow.

The progress of mankind is sympathetic, and I here cite a few instances of men who had already arrived at the same conclusion as myself. I received, about ten years ago, the first visit of M. Moreau, of the Society of Dramatic Writers, a simple theorist in aerostatics, but of a free and searching mind, who communicated to me the solution of this problem. M. Lazbereau, inventor of a motive power by expanded air, M. M——, engineer, son of a late celebrated deputy, had arrived, by observation alone and by simple logic, at the same solution. I also mention M. de Ponton d'Amécourt, inventor of the *aéronef*, and M. de la Landelle, whose efforts for the last three years have borne upon the practical demonstration of this system, and to whose kindness we owe the communication of a series of *helicopteric* models, rising by themselves into the air, and carrying graduated weights.

If obstacles which I am ignorant of, personal difficulties, have hitherto prevented the idea from being carried into execution, the moment has now arrived for its realisation.

The first necessity, then, for aerial automotion, is to disembarrass oneself of every kind of aerostat. That which aerostation refuses we must demand of dynamics and statics.

It is the screw which is to carry us through the air—it is the screw which penetrates the air as a gimlet does wood, the one carrying with it its motive power, the other its handle.

Every one has seen the toy called the spiralifer. It consists of four small flat fans, or rather spirals of paper, edged with wire, and attached at equal distances to a central spindle of light wood. This spindle is inserted into a hollow tube, with a rotary movement, upon an immoveable axle, which is held by the left hand. A string passed round the spindle, and quickly pulled by the right hand, impresses upon it a rotary movement sufficient to enable this miniature screw to detach itself and rise several yards high in air, whence it descends so soon as the force imparted to it has exhausted itself.

Let us now imagine spirals of a material and an extent sufficient to support any motive power whatever—steam, ether, compressed air, or the like—that this motive power has the permanence of forces employed in ordinary industrial pursuits; and it is plain that by regulating at will, as the driver does the locomotive, you can rise, descend, or remain motionless in space, according to the number of revolutions which you cause your screw to make.

But there is nothing like the testimony of the eyes. The demonstration has been established in the most conclusive manner by the various models of MM. Ponton d'Amécourt and de la Landelle—the one a man of the world, the other a man of letters—neither of whom are mechanics, and who have secured the services of two most skilled workmen, MM. L. Joseph, of Arras, and J. Richard.

These systems, different from the spiralifer, but more advanced than it, that they carry with them their motive power, testify abundantly, despite the *dictum* of Lalande, to the evident possibility of the ascent of bodies specifically heavier than the atmosphere itself.

It is not necessary to dwell upon the inevitable imperfection, yet so encouraging, of these trial engines, con-

structed under the worst conditions in every point of view, and which are purely in embryo. Suppose them carried out to perfection, and, to do this, confide them to proper workshops and mechanics—let a committee of competent gentlemen direct the details—and if this were done, I think the most sceptical mind would cease to have any doubts as to the possibility of aerial automotion.

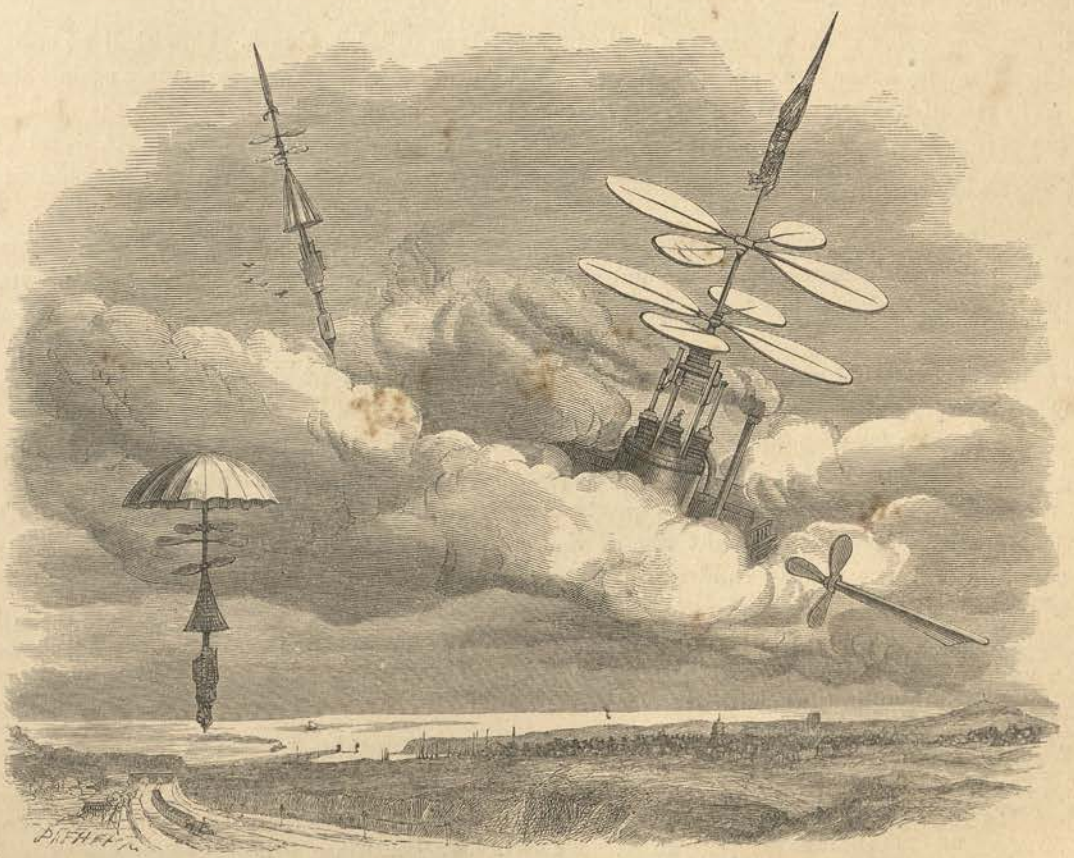
I wish, as far as possible, to meet beforehand every objection, so earnestly do I desire that all should share my own convictions. I suppose, then, admitting that, after all, practice too often gives the lie to theory, some one will boldly maintain that, on a larger scale—that is, on a scale commensurate with the proportions of the subject—the same results will not be obtained.

The answer is easy. It is, on the contrary, the amplification of weight and form upon which we depend for success; and, in fact, if our principle is once admitted—if our motive power X, representing, let us say, one-horse power, does not provide us with sufficient ascensional power, we have only one thing to do—to double the power of our water. If this two-horse power be insufficient, we take four horses, or eight, since, in proportion as we augment its force, we diminish relatively the weight of our water. And it is very certain that a ten-horse power weighs much less than ten forces of one horse, while giving the same result. We therefore diminish our load in proportion as we increase our force.

I think it may be admitted that the most difficult point has been passed, so soon as the screw provides us with vertical ascensional power, capable of being regulated at will.

The screw will complete its work by providing us with a horizontal propeller, the rapidity of whose rotation, exceeding that of the lifting screw, will be further increased by that obtained by inclined planes; and we have thus the means of directing the machine.

Let us consider the action of the parachute. A parachute is a sort of umbrella, in which the handle is replaced at its point of insertion by an opening intended to ease the excess of air, in order to avoid the strong oscillations, chiefly at the moment at which it is first expanded. Cords stretching symmetrically from divers points of the circumference, meet concentrically at the basket in which is the aeronaut. Above this basket, and at the entrance of



M. NADAR'S IDEAS.

the folded parachute, that is to say closed during the rise, a hoop of sufficient diameter is intended to facilitate, at the moment of the fall, the entrance of the air which, rushing in under the pressure, expands the folds more easily and rapidly.

Now the parachute, in which the weight of the car of the attaching cords and the wrigglings of the aeronaut are in equilibrium with the expansion—the parachute, which seems to have no other aim but to moderate the shock in falling—the parachute even, has been found capable of being directed; and aeronauts who have practised it, take care not to forget it. If the current is about to drive the aeronaut over a place where the descent is dangerous—say a river, a town, or a forest—the aeronaut perceiving to his right, let us suppose, a piece of ground suitable for his purpose, pulls at the cords which surround the right side, and by thus imparting a greater obliquity to his roof of silk, glides through the air, which it cleaves obliquely, towards the desired spot. Every descent, in fact, is determined by the side on which the inclination is greatest.

The inclined planes disposed on the platform of our aerial locomotive, and combined with the ascensional power which it yields, will furnish to it, then, independently of the horizontal screw, an assured means of locomotion.

It will be understood that it belongs not to us to determine at present, in this general statement, either the mechanism or the necessary manœuvres. Neither shall we attempt to fix even approximately the future velocity of aerial locomotion. Let us rather attempt to calculate the probable velocity of a locomotive gliding through the air, without the possibility of running off the rail, without any oscillation, without the least obstacle. Let us fancy such locomotive encountering on its way, in the midst, one of those atmospheric currents which travel at the rate of forty leagues an hour, and following that current; add together these formidable data, and your imagination will recoil in adding still further to these giddy velocities that of a machine falling through an angle of descent of from 12,000 to 15,000 feet in a series of gigantic zigzags, and making the tour of the globe in a succession of fantastic leaps.

The following are extracts from a lecture before the Polytechnic Association, and of letters to the 'Constitutionnel,' in 1863, on the use of the Aerial Screw, by M. Babinet, 'de l'Institut de France':—

1. The common theory of the guidance of balloons, properly so called, is absurd. How shall we make balloons like the "Flesselles," for example, which, measuring 120 feet in diameter, resist and manœuvre against atmospheric currents? The sail of a vessel would require 400-horse power to contend on equal terms with the wind. Suppose, which is impossible, that a balloon could carry up with it a 400-horse power, this great effort would absolutely serve no purpose, for you can easily see that under this pressure your balloon would be extinguished in its frail envelope.

This impossibility was admitted by every man of common sense. M. Nadar has given himself a great deal of useless trouble in order to demonstrate it. To finish, once for all, with the impossible guidance of balloons, suppose all the horses of a regiment attached by a rope to the cradle of a balloon, you would only obtain for result seeing your balloon burst.

It is quite otherwise that man should seek the means of raising himself, which means, at the same time, guiding himself in the air.

I bought once at a toy-shop a plaything which was then in fashion, called *strophéore*; this toy was composed of a small screw (*helice*), detaching itself from its support by rapidly pulling a string wound round its spindle. The *hélice* was heavy enough, weighing about a quarter of a pound, and its fans were of a very thick tin-plate. This *hélice* did not fly with impunity; its flight was so violent in rooms that it often broke the looking-glass on the mantelpiece and hurt the eyes of the children. Here you see one of these playthings, as I found many of them in Belgium and Germany, and whose power of ascension is so great, that I have seen them pass over the cathedral of Antwerp, one of the most elevated monuments of the globe. You observe that the air underneath is exhausted, and forms a vacuum in passing under the wings, whilst the air above rushes in. By this double effect the apparatus ascends.

MM. Nadar, de Ponton d'Amécourt, and de la Landelle, bring something better before us than this, although the wings of their different models are quite rudimentary, and really little worthy of people who wish to show something to those who are shortsighted. It is only yet the infancy of the process; but it is so far good, since it shows that the apparatus mounts into the air quite alone. We have here, gentlemen, gained the first step; for this result, small as it is, is fundamental.

The *hélice* (or screw) is not a novelty; *hélices* were made before they were called so. Windmills are only *hélices;* the wind presses upon its wings and causes them to turn. In turbines, where you see waterfalls of 300 metres utilised by a mechanism no bigger than a hat, the phenomena is the same, only the wind is replaced by water.

The aerial screw presents great difficulties; but if we succeed in raising by it a small weight, we are certain to be able to raise so much the more a heavier weight. The motion being in proportion to the capacity, it results that a large machine is always more efficacious than a small one. I repeat, your *hélice*, which without exterior motion raises a mouse, will carry an elephant ten times more easily.

These *hélices*, which seem at first to serve only for ascending and descending, resolve, moreover, the problem of its direction against a moderate wind.

Madlle. Garnerin once wagered to guide herself with a parachute from the point of its fall to a place determined and remote. By the combined inclinations which could be given to her parachute, she was seen, in fact, very distinctly, to manœuvre and tend towards the place designated, and her wager was gained almost within a few yards.

I have often watched, in the mountains, birds which hover, and I have distinctly remarked this procedure: when once they attain the maximum of ascension desired, they hover and let themselves fall with the open wings, in parachute manner, upon the point which they have chosen. Marshal Ney related to me that he has many times observed this manœuvre performed by large birds in the mountains of Algeria.

To sum up, it is positive that you have the means of transporting yourself, by the sole fact that you have in your possession the means of raising yourself. Height alone gives you direction: after you have obtained elevation, you have employed and invented a capital of strength which you have only to expend as you please.

2. I hasten to reach that which was to me the favourite part of my article, namely, aerial locomotion.

This will, by-and-by, be alone a serious article. At present I wish to prove one of the most important facts. Whilst in the academies they were speaking with indecision, and almost with indifference, of aerial *hélices*, and whilst children's toys, launched mechanically, were flying in turning at considerable heights, three amateurs, MM. Nadar and de la Landelle, both well known to the public, and M. de Ponton d'Amécourt, were smitten with a noisy passion for aerial navigation by means of the *hélice*. They constructed small machines which derived their motive power from a spring, and which raised them, wings and spring, without borrowing any impulsion from without. These small engines are, therefore, perfect automators, and take their point of support on the air they traverse. The form of the fans of the *hélices* remains to be studied, as well as the nature of the steam-engine which is required to furnish the motion; but, as a large model is always far more advantageous, mechanically, than a small apparatus of feeble capacity, we can say boldly, that if we have raised a mouse, we can far more easily raise an elephant. It is a question of money and mechanism, and not of science.

We can, then, guarantee success to aerial navigation within the limits of the possible; that is to say, that we shall never be able to proceed against the violent winds, which oppose the flight of the most vigorous birds. As to the exclusion of the aerostat, which MM. Nadar and de la Landelle loudly proscribe, it is long since every one versed in physics has declared the guidance of the balloons lighter than the air among the problems, not only insoluble, but which is absurd even to put forward.

I have studied much, theoretically and experimentally, the question of motive screws in air and in water. There is required, at first, a great speed of rotation in the wings; but we can put on a great number. A spring would give a steady movement to the fans, and the steam-engine, made of metal, ought only to be employed in maintaining the spring at the same tension. This will act as a fly-wheel to the motive power. As to the required speed, in order that the *hélice* may act energetically upon the air, I may say that in the experiments made along the fine basin of the Seine, below St. Cloud, a screw boat, whose worm was one metre, and which in 1000 revolutions, if the water had not yielded, would have made one kilometre (1000 metres), made only 200 metres when the *hélice* turned slowly. It thus lost 800 metres in 1000 revolutions, whilst, with a more rapid movement of the *hélice*, the boat, in 100 revolutions, advanced 800 metres, and lost only 200 metres.

Rapid movements have this advantage, that the air, obliged to yield to the impulsion, has not time to escape, and that it is strongly compressed as upon the anterior face of a cannon-ball. It is for the same reason that a parachute descends slowly; for in order to flow out by the borders, the air is compelled to make a considerable effort, at the expense of the body suspended to the parachute.

It is a true gliding of the bird upon the inclined plane of its wings, which transforms the position of elevation into a rapid course in a horizontal direction. The small lateral resistance which the *hélice* offers will here aid marvellously the horizontal progress, and the ascension will transform itself quite naturally into a progressive advance.

I shall conclude in saying, with M. de la Landelle, that even laying aside all idea of travelling, we should be able (I say *shall* be able), in case of fire, inundation, shipwreck, to render very efficacious assistance. Pliny says, "*Deus est juvare mortalem!*"—it is God-like to assist humanity. I guarantee the canonisation of MM. Nadar, de Ponton d'Amécourt, and de la Landelle.

3. What now do we ask for? On what point is the insatiable genius of human progress about to direct its efforts? After my last article, you will divine that I wish to speak of aerial locomotion under the names of MM. Ponton d'Amécourt, de la Landelle, and Nadar. Let us see what has been done, and what remains to be done.

Generally speaking, every question properly stated is more than half resolved, when it does not contradict any of the four grand laws of nature—the laws of mechanics, physics, chemistry, and physiology. Now aerial navigation does not contradict any of these codes; it is therefore possible. MM. Nadar, de la Landelle, and d'Amécourt, have undertaken with much stir the solution of this question—to wit, to construct a screw machine which shall raise a man and enable him to support himself indefinitely in the air; in short, to enable him to move from a certain point in the direction of and towards the spot desired. Now this, I maintain, can be done of a certainty.

It will be said to me, Why do you adopt with so much warmth the ideas and hopes of these gentlemen?

I reply, Because they have been for a long time my own. For more than fifteen years I have preached aerial navigation by means of the screw. I have conferred about it with all our celebrated mechanicians, and if MM. Ponton d'Amécourt and de la Landelle had not *realised*, as they have done, automative apparatus which carry their active power along with them, I should consider myself, as well as a great number of geometricians and natural philosophers, entitled to claim the idea of the air-travelling *hélice;* and more than that, I should be able to produce all the infallible mathematical calculations which guarantee the success of this aerial navigation. These calculations are analogous, not to say identical, to those which have been made for the sails of the windmill, the vanes of the turbine, for ventilators and the maritime screw. For all these motors the result has been the same as that which the mechanical formulæ indicated.

With the small models shown to the public at a numerous meeting at M. Nadar's, and by myself at a conference of the Polytechnic Association in the Amphitheatre of the School of Medicine, before some thousand auditors, this apparatus, provided with springs wound up to a moderate pitch, was seen to raise and sustain itself in the air during the whole time of the action of the spring. Now, if a small steam apparatus, easy to imagine, had restored to the motor-spring the tension which it loses in putting the screw into motion, the mechanism in question would have been indefinitely raised, sustained, and directed, in the midst of the atmosphere.

In a publication of the helicopteroidal triumvirate, these gentlemen observe with just reason that a ten-horse power steam-engine weighs incomparably less than ten machines of one-horse. It is said in fortification that a small place is a bad place; it is still more true to say in mechanics a small motor is a bad motor. The greater part of the deceptions which ruin inventors arises from this, that they judge of the effect of a machine by that of a small model, which is what they call a *chef-d'œuvre*, not susceptible of working on a large scale. It is similar to the case of those who calculate the produce of a field by the returns of a crop gathered from a box in their window-sill.

Whilst MM. Ponton d'Amécourt and de la Landelle were constructing their small automotives, M. Nadar, who, like many others, had also thought of the screw, but who had also gained experience of aerostation and its insufficiency, was placed in relations with the two partisans of the screw. He entered with ardour into the triumvirate of which I have spoken, and became the efficacious promoter of the common idea.

Here, then, we have between these gentlemen and myself the plan adopted to advance aerial navigation with certainty by means of the screw. A little model on an exact scale will be constructed, at a moderate expense. A small high-pressure steam-engine will be constructed with a thin cylinder and light piston, and its power will be applied to the motor-screw of the apparatus already constructed, and will wind up this spring continually, restoring the force it loses by its action on the double ascensional screw. When we are in possession of an apparatus which shall raise itself carrying only two pounds, we shall be able to calculate the expense of a machine capable of raising a man or any weight whatever, and susceptible, with aerial propellers, of directing itself (with certain limits of speed) in an atmosphere which shall not be dominated by a too violent wind. Let us observe that the screw, the

blades of which are nearly horizontal, gives but small hold to the wind, which irresistibly carries with it the ordinary aerostat. When a complete helicoptère of small power is obtained, it will be an affair of money to construct one of greater power, and the expense will be easily covered by an association which will find in public curiosity or otherwise an assured remuneration for the first outlay.

To these I annex a paper on aerial locomotion, by M. Barral, a French aeronaut, taken from the 'Presse Scientifique,' 1863:—

Everybody knows that I have travelled in balloons; hence it happens that every year I am receiving hundreds of communications on the guidance of aerostats. Most frequently I reply to inventors that I find their systems impracticable. They take the balloon almost just as it issued from the hands of the first aerial traveller—a huge envelope for a gas lighter than atmospheric air, upon which rests a net which carries certain ropes attached to a strong wooden hoop; to this hoop they suspend, still by ropes, a car, where they pretend to place, with the voyagers, the motor intended to direct the machine. But they fail to perceive that this machine will in vain develop the power they wished, for it will work like a dead rigger, at the extremity of ropes which can transmit nothing to the balloon above, because they are not rigid; besides, this balloon has such dimensions, that to contend against the air which bears it would require immense powers, of which they may form an idea in reflecting on the power of the winds on the windmill and on the sails of the ship.

Most frequently, then, I see only in the inventors of balloon-guidance Lilliputians suspended by ropes round the middle, and pretending, by shaking themselves, to change the place of the hook in the ceiling to which the rope is attached. But a different impression is produced upon my mind by those who begin by telling me that they would change the conditions of the construction of the aerostats. As I have the conviction that aerial navigation is one of the near conquests incontestably reserved for man, I attach the greatest value to every effort made to combine a machine where the gas, lighter than air, shall do no more than serve to diminish the mean density of the apparatus, and where the motive power shall be able to exert itself ulteriorly on the directing organs, without finding in the support a power out of proportion to the power which the traveller shall be able to dispose of. On this account, the recent publications of M. Nadar, and the communications which he has been pleased to make to me personally, could not but highly interest me. It is my duty, I consider, to speak out now that M. Babinet has approached this subject in two profound and witty articles such as he alone knows how to write, in the 'Constitutionnel' of the 15th and 29th of August.

It was at the beginning of this month that M. Nadar publicly made known his ideas on aerial locomotion, at a meeting to which he had invited a good number of *savans*, engineers, writers, and gentlemen. I could not then be present, but here is what I read in a kind of Report sent to the journals:—

"M. Nadar presented to the assembly an explanation of the theory for aerial auto-locomotion by the suppression beforehand, and *absolutely*, of every aerostat, and by the employment instead, of the screw and inclined planes. In recognising that this theory was not new, since, in 1768, fifteen years before the ascent of the first Montgolfier, Paucton, the engineer, predicted for the screw its employment in aerial navigation, M. Nadar invoked the sympathetic concurrence of all to popularise the idea, and to facilitate at the earliest its practical application.

"M. de la Landelle confirmed M. Nadar's explanation in causing several models to work, constructed according to the system of M. de Ponton d'Amécourt, his fellow-labourer. These helicoptères raised themselves automatically, carrying graduated weights, and superabundantly demonstrated the certitude of the theory."

We must not take M. Nadar quite according to the letter when he speaks of the *absolute* suppression of the balloon; he does not renounce, evidently, all means for diminishing the specific weight of the apparatus which he thinks he is able to make use of. In fact, he has taken for epigraph to an article which we published in the 'Presse,' of the 4th of August:—"In order to contend against the air, it is necessary to be specifically heavier than the air;" but he had taken care to write in a note, "I know that some will like to fasten upon the very letter of this formula, whose terms I have exaggerated on purpose, and will feign to mistake it, which to me is indifferent."

M. Nadar's fundamental idea is, "to support oneself on the air, and no longer to give support to the air;" as, in fact, it is the case in the common balloon, where the ascensional power is only the difference between the total weight of the aerostat and a weight of atmospheric air equal to that of a column of air filling the space occupied by the aerostat. To support oneself on the air, M. Nadar proposes the *hélice*, animated by a great speed, the same as

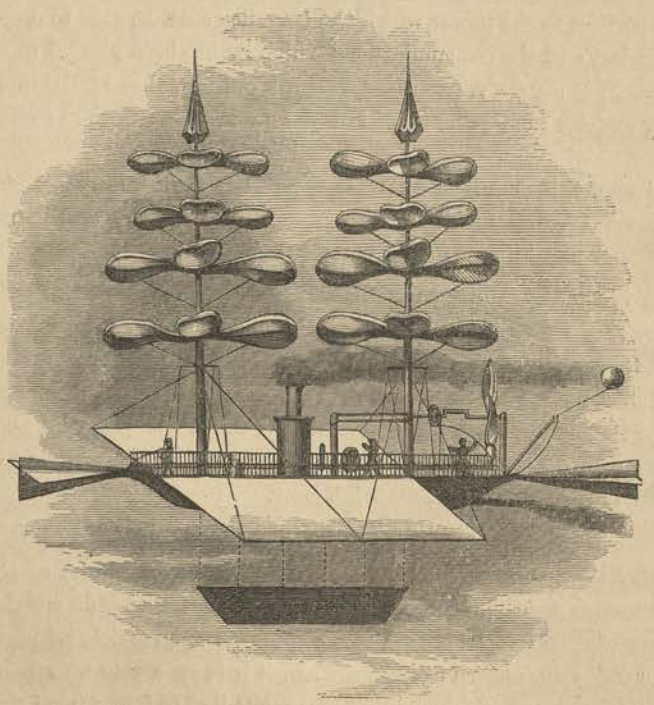
M. Petin, fifteen years ago, proposed inclined planes. M. Babinet has developed this idea in his article in the 'Constitutionnel,' of the 15th August. I desire and ought to allow the learned natural philosopher to speak for himself.

M. Babinet is completely of my opinion on the impossibility of directing the balloon, with which we all, who have dared to make the experiment, were raised in the air, contenting ourselves to ascend, and allowing ourselves to be carried by the strata of air where our ascensional power had conducted us.

It ought to be said that the guidance the screw can impress, in order to mount in such or such a direction, is perfectly demonstrated by M. Babinet. The bird that flies, is it not also a machine which may serve for example? Should we not, in fact, endeavour to imitate the constitution of the bird, as an eminent agriculturist indicated on the 20th August to the Central Society of Agriculture, in citing certain experiments where he had obtained, by the sole relaxing of springs, a notable ascent of bodies in equilibrium in the air? In order to proceed with success in this new direction, we ought not to neglect having recourse to light gas, to diminish the too great mass of metals, as the warm air of the bird circulates in its feathers. But the screw will elevate and direct the aerial ship; it is its essential feature, and which M. Nadar wishes to realise with an ardour worthy of every encouragement.

It is only in trying experiments that we shall succeed in resolving the problem laid down by M. Nadar. The young child has much trouble to arrive at being able to stand upon his legs; the grown man no longer remembers the studies of equilibrium to which he very often succumbed during his early months. Let us come, then, to the aid of willing inventors, who are smitten with a passion for aerial locomotion. We applaud their next experiments.

There will, indeed, be much labour in order that these ideas may materialise themselves. Before becoming the steamboat, which crosses seas in all weathers, the first log of wood floating on the water demanded of the genius of man immense inventive efforts. The aerostat is little more than a frail canoe guided by savages. But the man of the nineteenth century has acquired experience enough to surmount the obstacles which aerial navigation presents, and which are nothing compared with all those which he has already triumphed over. Honour, then, to those who are making search for aerial navigation. The learned owe them their aid, and not their disdain.



M. DE LA LANDELLE'S IDEAS.

"WHEN WE DISCOVER, OR THINK WE DISCOVER, ANY FACT IN THE ECONOMY OF NATURE WHICH WE HAVE REASON TO BELIEVE HAS NOT PREVIOUSLY BEEN OBSERVED, LET IT, AT LEAST, BE VERIFIED AND RECORDED. NO TRUTH IS ALTOGETHER BARREN; AND EVEN THAT WHICH LOOKS, AT FIRST SIGHT, THE VERY SIMPLEST AND MOST TRIVIAL, MAY TURN OUT FRUITFUL IN PRECIOUS RESULTS."

The ideas of Nadar and the aeromotive party, so boldly expressed, have drawn forth the energies of those who foresee the practicability of guiding aerostats; and among the many pamphlets that have recently appeared in Paris, one published in 1864, by M. David, a Member of the Aerostatic and Meteorological Society, seems to be the best. It is the result of ten years' study. It bears the title of 'Solution du Problème de la Navigation dans l'Air,' and in it he makes the following remarks:—

Two objections to this new science have been made that have some weight and are worthy of the trouble of refutation, so I will here answer them.

The 1st objection is, to suppose that the ascensional power of the aerostat can only be augmented by greatly extending the surface, and that the resistance of the air against this surface would always paralyse the efforts to move. It is said, a locomotive attached to a balloon is movement associated with immobility. It is like a steam-engine attached to a cathedral to cause a change of locality, &c.

Those who reason in this way have doubtless never seen an inflated balloon moved from one place to another by a rope. One man can do this, unless the wind should be high. Neither have they noticed the rapidity with which a balloon rises: for, if the resistance of the air was considerable, it would require prodigious force to give it this motion; whilst in reality the ascending power is derived from deducting some forty or sixty pounds from the aerostat.* This shows less locomotive power than what a man possesses in his own body. Now, the resistance of

* Instances of remarkable Rapidity in Ascending.

Gay Lussac, *Sept. 15th*, 1804.—9·40 A.M.; Bar. 30·66 inches, Ther. 82° Fahr.

1 hour 13 minutes ascending 23,040 feet above the sea,
or 22,912 feet above Paris.

At 11.3 A.M. he was 4¼ miles above the sea.

Messrs. Graham and Beaufoy, *June 17th*, 1824.—6.5 P.M.; Bar. 29·80 inches, Ther. 66° Fahr.

| P.M. | | inches. | | feet. | |
|---|---|---|---|---|---|
| At 6. 8 | Bar. was | 27·40 | or | 2,257 | Ther. 46° |
| „ 6.12 | „ | 25·50 | „ | 4,235 | „ 45° |
| „ 6.16 | „ | 23· 3 | „ | 6,605 | „ 39° |
| „ 6.20 | „ | 21·60 | „ | 8,608 | heard report of a cannon. |
| „ 6.40 | „ | 19·20 | „ | 11,711 | „ 32° |

The highest point nearly 2 miles in 32 minutes.

Messrs. Green and Rush, *Vauxhall, Sept. 10th*, 1838.—At 6.30 P.M. *the balloon was released with* 112 *lbs. ascending power, and in* 7 *minutes they had passed an altitude of* 2 *miles*; the greatest height reached was 5 miles 746 feet; and they descended at Lewes, in Sussex, at 7.45 P.M.

Dr. Zeize of Altona, and Mr. Coxwell *at Hamburg, Nov. 4th*, 1849.—Time of starting, 3 P.M.

| | | |
|---|---|---|
| 3. 5 P.M. | 3,348 | feet above the sea. |
| 3.10 „ | 3,628 | „ over the Elbe. |
| 3.15 „ | 3,911 | „ |
| 3.20 „ | 4,084 | „ |
| 3.25 „ | 4,923 | „ |
| 3.30 „ | 4,433 | „ |

Or at the rate of a mile in 30 minutes.

Messrs. Green and Welsh, *Aug. 17th*, 1852.—Started, 3.49 P.M.; reached 19,510 feet at 4.46 P.M.

Messrs. Green and Welsh, *Nov. 10th*, 1852.—Started, 2.21 P.M.; reached 22,930 feet at 3.16 P.M.

Messrs. Glaisher and Coxwell, *Wolverhampton, July 17th*, 1862.—Time of starting, 9.43 A.M.

| | | |
|---|---|---|
| At 9.49 A.M. | 4,467 | feet above sea-level. |
| „ 9.55 „ | 8,809 | „ |
| „ 10. 2 „ | 11,792 | „ |
| „ 10.15 „ | 16,912 | „ |
| „ 10.30 „ | 19,415 | „ |
| „ 10.50 „ | 21,059 | „ |
| „ 11. 7 „ | 25,077 | „ |

Or nearly 5 miles in 1 hour 24 minutes.

Messrs. Glaisher and Coxwell, *Wolverhampton, Aug. 18th*, 1862.—Started at 1 hr. 2 min. 38 s. P.M.

| | | |
|---|---|---|
| At 1. 5 P.M. | 1,130 | feet above sea-level. |
| „ 1.10 „ | 4,138 | „ |
| „ 1.14 „ | 6,585 | „ |
| „ 1.20 „ | 11,262 | „ |

Or nearly 2 miles in 18 minutes.

Messrs. Glaisher and Coxwell, *Wolverhampton, Sept. 5th*, 1862.—The highest ascent on record; height attained, 7 miles.

Left the earth at 1 hr. 3 min. 20 s. P.M.

| | | |
|---|---|---|
| At 1. 6 P.M. | 1,480 | feet above sea-level. |
| „ 1.13 „ | 5,675 | „ |
| „ 1.22 „ | 10,770 | „ |
| „ 1.38.25 s. | 20,126 | „ |
| „ 1.53 P.M. | 29,000 | „ |

Or 6 miles in 47 minutes.

The last mile Mr. Glaisher was insensible, but self-registering instruments and Mr. Coxwell's observation of an aneroid standing at 7 *inches*, proves that a height of 37,000 feet was attained.

Messrs. Glaisher and Coxwell, *Crystal Palace, March 31st*, 1863.—Left earth at 4.16 P.M.

| | | |
|---|---|---|
| At 4.18 P.M. | 1,515 | feet above sea-level. |
| „ 4.24 „ | 5,296 | „ |
| „ 4.35 „ | 10,047 | „ |
| „ 4.45 „ | 15,793 | „ |
| „ 5.15 „ | 20,136 | „ |
| „ 5.28 „ | 24,000 | „ |

Or 24,000 feet in 1 hour 12 minutes.

Messrs. Glaisher and Coxwell, *April 18th*, 1863.—Reached the altitude of 24,000 feet in 1 hour and 13 minutes.

It is much to be regretted that the rapidity of many other ascents has not been chronicled; until these facts were obtained from Mr. Coxwell, the author was under the impression, with others of the party who shared the Winchester Experiment, that they had the felicity of moving at the rate of 3 miles a minute, as stated in the letter in the 'Times' (see page 243 of this book). Such is the reliance that can be placed in one's own senses on novel situations.

Instances of Remarkable Rapidity in Descending.

Two authentic instances will suffice: the one when Mr. Coxwell told Mr. Glaisher, "We must save the land," when immediately over Beachy Head. They descended 2 miles in 4 minutes, and alighted on that promontory. On another occasion, when the ascent was from Wolverhampton, they descended 3 miles in 9 minutes.

the air vertically and horizontally is the same; whence it is clear that less than the strength of a man will cause the supposed fixture to move. The increase of surface doubtless augments the resistance; but the air is so diaphanous, being 900 times less dense than water, that the increase is really insignificant. An aerostat has no friction, and the cylindro-conical is the best form for movement.

The 2nd objection is, the effect of the wind on the surface of the balloon. For all that one may do, it has been said the wind will always carry with it so large a surface, and any locomotive must be useless.

This objection is serious. I have weighed it in my mind a long time, and I solve it in this manner:—

A free balloon is a slave to the winds, following their slightest caprices. But I ask the cause.

Is it the strength of the wind that gives it this power? No; for the least wind will move the balloon as well as the strongest. Its movement is then indeed less rapid, but it is because the wind itself moves less rapidly.

Is it on account of the extent of the balloon's surface? We may again say, No; for the smaller balloon is influenced equally by the wind. The reason, then, for the dominion of the wind over the balloon is the absence of all resistance.

The particles of air that surround the balloon do not change their place; it is, therefore, as much enclosed as is the passenger in the railway-carriage.

The wind is the auxiliary of the sailing-ship; wherefore this difference? Because the ship finds in the water resistance sufficient in some degree to neutralise the wind, and can therefore tack at will.

What, then, does a balloon require, that it may be guided like a ship? Only to create a resistance that is wanting to annihilate the force of the wind, and give it a counterbalancing power.

Within these limits we find the difficulties considerably lessened. To cause it to disappear entirely there remains now only the demonstration of the practicability of creating the resistance that will counterbalance the strength of the wind.

Many methods can produce this result. I shall notice one.

The screw, by its simplicity, extreme facility of action, and its characteristic of acting when entirely submerged in a fluid, constitutes assuredly the best propulsive agent that aerial navigation can make use of, both to resist the effect of the wind and to cause movement in a calm atmosphere. Let us suppose two screws, of very large dimensions, placed on the right and left of the aerostat (we are talking here of an elongated form), with rotary movement parallel to the length of the equipage, capable of being turned at will either way. These screws, put in motion, must necessarily draw the aerostat to the right or left, according to the direction of rotation they receive. This fact being established, their use in effecting the object proposed now comes under discussion.

To resist by their aid the influence of the wind it will suffice to put them in motion either one way or the other, so that they might always work their way through the air in the direction from whence the wind does come. They cannot then possibly fail to furnish the resistance required.

There is yet a final question to examine. In what proportion will this resistance be created? Will it be sufficient to neutralise the force of the wind?

With the materials that aerial navigation can actually make use of at the present time, we can answer, Yes; but industry is now devising new screws, combining extreme lightness with great strength; and it will be shown that a balloon of the necessary dimensions for effecting a truly aerial voyage, furnished with these agencies, can easily create a force equal to and even superior to the wind.

Be it understood that I am not here speaking of a hurricane or tornado, but of the ordinary atmospheric currents. In such a difficulty, what is best to be done is either to reach the higher and calmer regions of the atmosphere, or to descend to the earth for shelter. I have here cited by preference this method for obtaining resistance, because it is the easiest one in which to show clearly that the action of the wind on a balloon can be victoriously overcome; but I do not propose that it should be the exclusive means of future aeronautics. In a following section (wherein propulsion by purely mechanical means is treated of) I shall propose a second, less energetic, but even more simple, which, under certain circumstances, might replace what we have just mentioned with advantage.

## "Appareil."

Before describing the combination of means by which I propose to obtain movement and guidance in the air I ought to observe that in aerial, like marine, navigation, two distinct methods of propulsion exist, viz., the

propulsion by sails, with the wind as a motive power, and the propulsion by a mechanical agent, such as the screw, for instance, making the specific gravity of the air its *point d'appui*.

I will speak first of the propulsion by sails, and then of the means purely mechanical.

### Propulsion by Sails.

I derive the ascensional power from a lutestring gas-holder, varnished or vulcanised, of elongated form, slightly arched in its upper surface, and terminating at either end in a hemisphere (Figs. 1 and 2, A A). I say

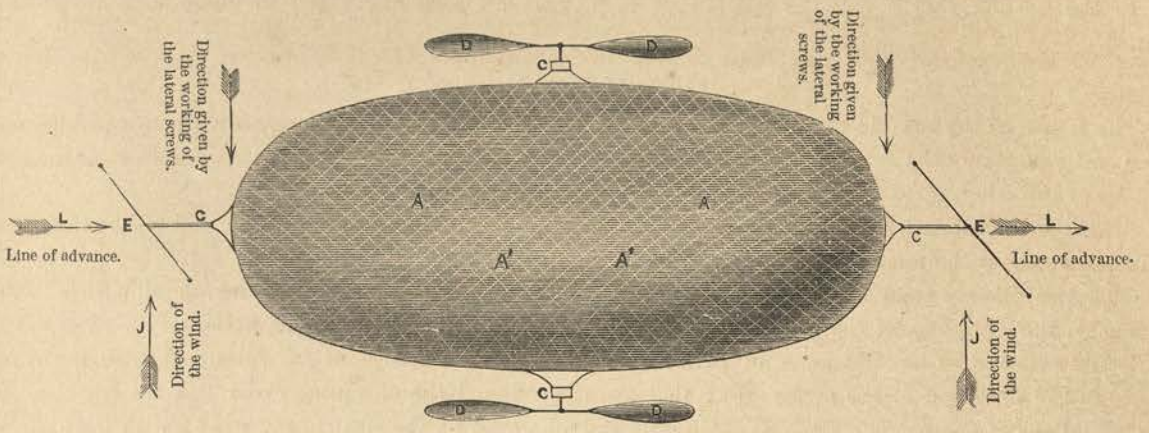



Fig. 1.—Horizontal Section of the Sailing-Aerostat.

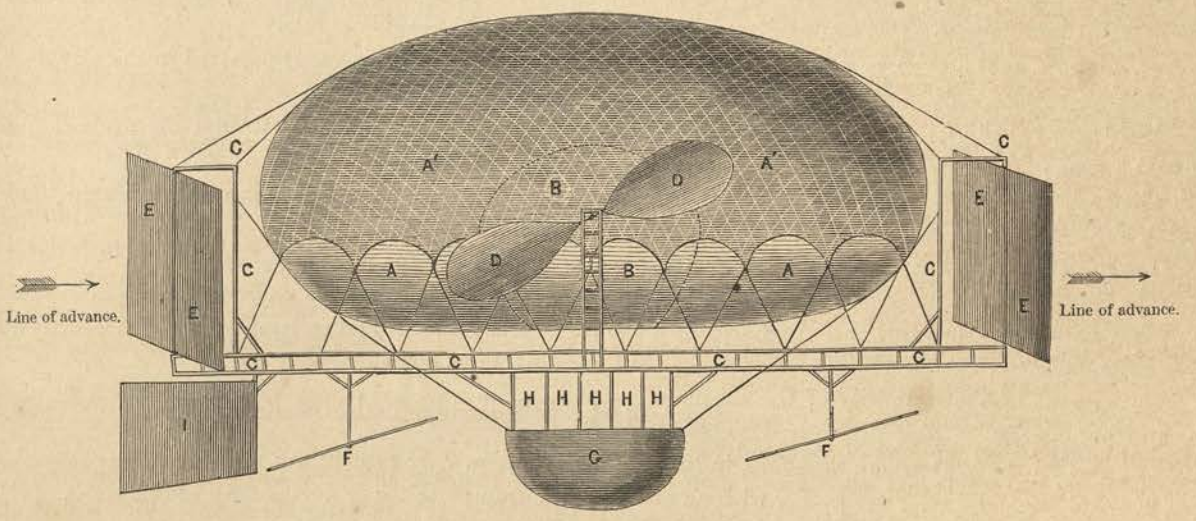



Fig. 2.—Vertical Section of a Sailing-Aerostat (the right side).

lutestring, from its being the best tissue for the purpose hitherto invented; but there is reason to believe that metallic gas-holders will one day be constructed.

Inside the aerostat, attached to the lower half, I place a balloon of much smaller dimensions, whereby ascent and descent can be effected without loss of either gas or ballast. It is connected with a reservoir of compressed gas, placed under the car; and by mechanical means this balloon can either be filled with gas or atmospheric air, according to the wish to ascend or descend (Fig. 2, B B).

Netting covers the gas-holder (Figs. 1 and 2, A A). At the lower extremities of this net, and under the gas-holder, is suspended a horizontal wooden framework, which serves to support the screws and the sails of which we are going to speak (Figs. 1 and 2, C C C C C C).

To the right and left of the gas-holder are double-armed screws, which I shall call the lateral screws, from their position. Their length should be about equal to the gas-holder's diameter, and are so fixed that their axis

should be at right angles with the length of the gas-holder. They receive their motion from an engine, that may be worked either by steam or expanded air, and is to be placed in the car (Figs. 1 and 2, D D).

At the prow and stern of the gas-holder are two inclined planes of stretched canvass, mounted on a pivot, capable of turning to the right or left; these I call the vertical sails, Figs. 1 and 2, E E.

Under the gas-holder before and behind the car are two inclined planes, fixed also on pivots, but only acting horizontally; these I call the horizontal sails, Fig. 2, F F.

Finally, under all, is the car for the passengers, provisions, and the engines for working the screws, Fig. 2, G G. This car is attached to the framework before mentioned by several uprights of wood or iron, Fig. 2, H H H H, and also to the netting that covers the gas-holder, to prevent all oscillations, and to consolidate all parts of the aerostat.

### The Navigation of a Sailing-Aerostat.

The object of the lateral screws, D D, is to oppose the currents of the atmosphere with an equal force. They consequently turn so as to screw up against the wind. Their movement should be more or less rapid, according to the force of the wind, and should be so adjusted as to cause equilibrium.

This result obtained, the aerostat is in exactly the same position as a sailing-ship; and what causes the latter to advance is, the decomposition of the force of the wind by tacking. The analogy is apparent; for it will suffice to incline the vertical sails, E E, so that they present to the "wind's eye" the most advanced lateral extremities. (See Fig. 1, the situation of the sails in relation to the wind, represented by the arrows J J.) The force of the wind being opposed by the resistance of the lateral screws, the inclination of the sails will cause the aerostat to advance in the direction of the arrows L L; that is to say, across the current. From this we see that *the lateral screws are the soul of this system.* Without them sails and all would be the slave of the wind; with them the aerostat resists; the enemy is transformed into a beneficent ally, and the practicability of sails is henceforth demonstrated. It is clear also, from having vertical sails at each extremity of the aerostat, you can shift the direction by giving them different inclinations. One can understand also how it would be possible to turn completely round. I should, however, propose that a helm be also tried (Fig. 2, I); tacking can then be as easily effected in the air as on the water.

I will now speak of the uses of the horizontal sails. They can cause (but only during the movement of the aerostat) ascent or descent, without loss of gas or ballast.

The inclination of these sails is sufficient to do this, and they become, as it were, inclined planes; and the aerostat, obedient to the slightest impulse, must rise or fall by gentle gradation.

The internal balloon is necessary to cause a vertical ascent and descent when required.

The simultaneous employment of these two assistants might on some occasions be of use. The horizontal sail will, when experience has been acquired, diminish the fluctuations caused by the temperature and electricity (as yet so little understood), and will, therefore, make the line of march as horizontal as it can be.

On account of the simplicity of the means of propulsion, I cannot but foresee that the pace will be slow in calm weather.

The sailing aerostat seems, therefore, in the future navigation only to hold the place of sailing-ships, being made of great size, and carrying goods, whereof the delay in transportation is a secondary consideration. When, however, speed is desired, mechanical propulsion, such as I will now describe, must be resorted to.

### Mechanical Propulsion.

The mechanically propelled aerostat is, in the main, constructed the same as the sailing-aerostat.

These are preserved intact:

The gas-holder (Figs. 3 and 4, A A).
The interior balloon (Figs. 4, B B).
The netting that covers the gas-holder (Figs. 3 and 4, A A).
The fixed framework (Figs. 3 and 4, C C C C C).
The lateral screws (Figs. 3 and 4, D D).
The car with the engine (Fig. 4, G).

Besides these the new apparatus contains the following additions:—

At the prow and stern of the gas-holder, instead of the vertical sails of the sailing-aerostat, there are two screw-propellers (Fig. 3 and 4, o o), similar in every point to the lateral screws, receiving their movement, like them, from the engine in the car. I would draw particular attention to the *large dimensions* of these screws: on account of the extreme mobility of the air, and the feebleness of the *point d'appui* that it presents, necessitates size to obtain efficiency.

These screws are fixed so that their axle is parallel to the length of the aerostat; they are therefore at right angles with the lateral screws.

On either side of the car are vertical sails (Fig. 4, EE), as well as the horizontal sails, F; and at the stern rudder, I.

### The Navigation of a Mechanically Propelled Aerostat.

In this system of screw-propellers, o o, their object, as the name indicates, is to cause the movement of the aerostat. Being put in motion by the engine in the car, they work their way through the air; the one drawing, and

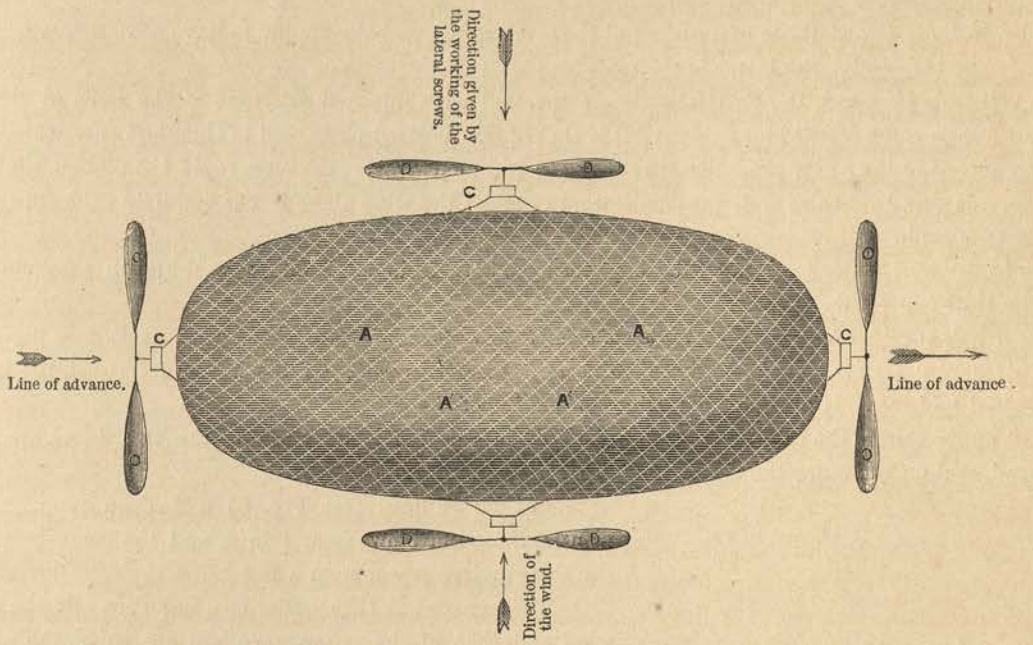



Fig. 3.—Horizontal Section of an Aerostat mechanically propelled.

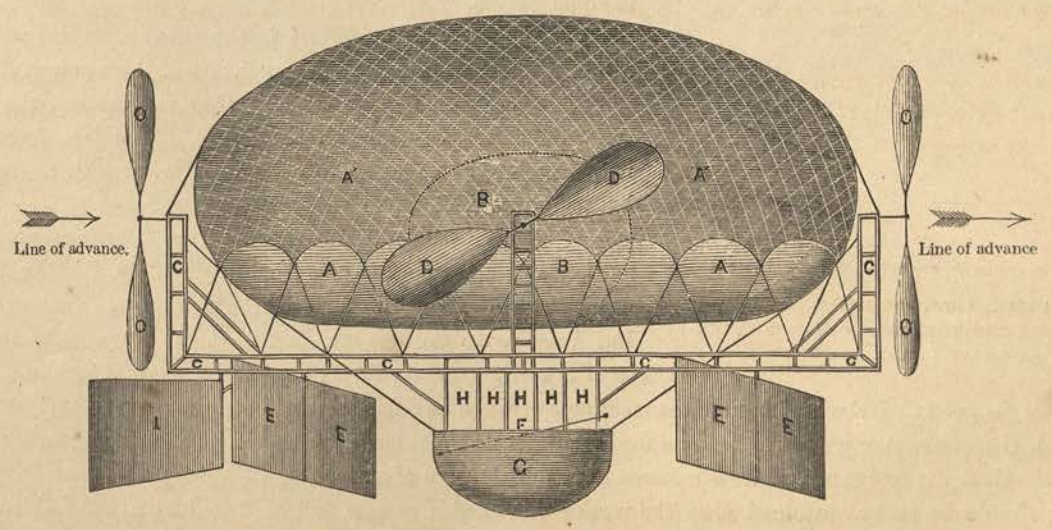



Fig. 4.—Vertical Section of an Aerostat mechanically propelled.

the other pushing the aerostat. [I must here remark that I anticipate less result from the screw-propeller at the bow, than I do from the one at the stern, on account of the current of air that this screw will throw on the gas-holder. If experience shows its inconvenience, it must be done away with.]

Such remarkable successes as those obtained by the experiments I speak of at the commencement of this book, with such small models that the motive power was scarcely anything, can leave no doubts as to the wonderful results which will accrue to future aeronautics from the screw-propeller. Being adapted to an aerostat sufficiently large to carry the requisite engines, it will devour space without effort, and leave behind, as far as rapidity is concerned, all means of locomotion hitherto known.

It is the extraordinary power of the screw that forms the basis of this system, and will assign to it the first rank among the appliances hitherto contrived.

Other aids are made use of in the following ways. The rudder acts as in a ship:—The horizontal sails, though not in the same position as in the sailing aerostat, will equally cause ascent or descent without loss of gas or ballast. The lateral screws, as before, resist the power of the wind. The vertical sails are now invested with the same power.

I indicate these two methods of arriving at the same result, as both appear to have advantages. If, in reality, the former is most energetic, the latter is the more simple: experience alone can decide.

The principle by which the vertical sails are invested with this new attribute is the same as that by which the horizontal sails cause ascent and descent; it is that of the inclined plane. It is therefore only when the aerostat advances by means of the screw-propeller that they can become effective; the more rapid the motion, the more power they possess. It may here be as well to remark, that to resist the wind there is not required such opposing force as is generally supposed.

This, to be well understood, must be explained. There is in mechanics a well-known elementary principle that may be thus expressed:

*When a body is subject to two forces that would drive it in different directions, forming between them an angle more or less open, it follows neither the one nor the other, but takes an intermediate course.* If the forces are equal, the intermediate direction is just midway. If unequal, it inclines to the line of the stronger force.

Let us apply this to the case before us. The body in question is the balloon; the two forces are, on the one side the wind, and on the other the screw-propellers.

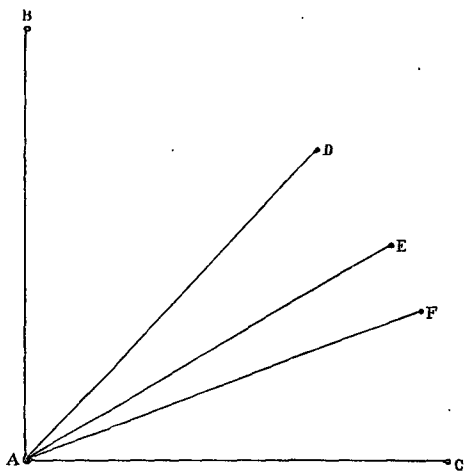



FIG. 5.—DIAGRAM SHOWING THE COUNTERBALANCING FORCE AND THE LINE OF MARCH TAKEN BY AN AEROSTAT IN THE AIR.

Let us suppose (see Fig. 5) a balloon represented by the point A, the wind blows from A to B, and the screw-propellers exercise their motive power from A to C.

The aerostat is then under two impulses. If the force of the wind and that of the screw-propellers are equal, the aerostat will evidently have its line of march from A to D, subdividing the angle in equal halves.

If the force of the screws is the greater, its line will be from A to E, A to F, according to the superiority of their power.

We may see, by this example, that in resisting the wind the screw-propellers will do half the battle. The lateral screws will not, therefore, be required to oppose the wind with an equal force, but merely to make up the difference.

One may fancy, perhaps, that I am glossing over the difficulties, and am appealing to the imagination for the facts that demonstrate the superior force of the screw over that of the wind. But I desire to impress the fact that *the foregoing reasoning is not based on abstract theory, but on experiments made out-of-doors, with small models, before the public.* Notwithstanding the smallness of these models I obtained conclusive results.

What, therefore, may we not anticipate for larger aerostats, as size increases the power of the machine so much more rapidly than the resistance of the air increases from extension of surface.

If it should be still maintained that the weak point of this system will be found from the feebleness of the *point d'appui* that can be obtained from the air, I will point to windmills. Their sails put in motion large grinders

and coarse machinery. Great power is required for this; whence is this derived? From the wind that propels them in striking on their inclined surfaces. Now, if the wind (*i.e.*, air in motion) can produce this result in striking on the sails of the windmill, why should not the sails, put in motion by an engine with the same power as the wind, make them into screws, by striking on the air? Is it not therefore evident that, if the power that moves the screws surpasses that of the wind, the result of the labour afforded by the screws will also be superior to the force of the wind?

### The immense Resources of large Aerostats, and their Influence on future Aeronautics.

Those readers who have had but little acquaintance with the abstract sciences, will doubtless be led to treat as an illusion the importance given in this work to large over small aerostats; for it will occur to them that if they have more ascensional power, and can carry larger engines, the resistance they will meet with will be increased; that all the conditions will remain the same, and greater speed will not, therefore, be obtained.

This reasoning, logical in appearance, has in reality no foundation, as it rests in error. I will demonstrate this error, and establish at the same time the truth of my assertions on the magnificent resources that will accrue to aerostation from the use of large aerostats.

All know the ascensional power is owing to the volume of the gas, and, again, the resistance to be overcome is the surface presented to the air.

That agreed upon, let us see if the conditions remain the same for the large as for the small aerostats.

That this should be the case, it would clearly be necessary that the proportion between the volume and the surface should increase proportionately.

Now, geometry shows us that volumes are composed of *cubes*, and acquire, therefore, when their dimensions are augmented, a growth far superior to the increase of their surfaces, which comprises only the *squares*.

In applying this to the question in hand we arrive necessarily at this conclusion, that the increase of the ascensional power is at a much larger ratio than the increase of resistance from the extension of surface, and this difference becomes more apparent with the increase of size.

The conditions are therefore very far from remaining the same. But in such things nothing is more eloquent than figures; with these, therefore, I will end this demonstration.

Suppose four cylindrical aerostats, and numbered as follows, with subsequent dimensions;—

| | Diameter. | Length. |
|---|---|---|
| Number 1 .. .. .. | 1 metre .. .. | 5 metres. |
| Number 2 .. .. .. | 4 metres .. .. | 20 „ |
| Number 3 .. .. .. | 12 „ .. .. | 60 „ |
| Number 4 .. .. .. | 20 „ .. .. | 100 „ |

Let us see what will be the respective dimensions of the volumes and the superfices. On account of their convex form they offer less resistance to the wind than that of the plane surface diameter on which these calculations are based. Let us take the lateral surface as a parallelogram formed by the length and height of the gas-holder, and the front by the circle that describes the circumference.

This will be the result in round numbers:—

| Numbers. | Volume in Cubic Metres, or Ascensional Force in Kilogrammes.* | Lateral Surface in Square Metres. | Fronting Surface in Square Metres. |
|---|---|---|---|
| 1 | 4 metres. | 5 metres, or $\frac{1}{4}$ more than the cubic metres representing the volume. | 0·8 metres, or $\frac{1}{5}$ of the number of the cubic metres representing the volume. |
| 2 | 250 metres. | 80 metres, or $\frac{1}{3}$ (about) of the number of the cubic metres representing the volume. | 12·5 metres, or $\frac{1}{20}$ of the number of the cubic metres representing the volume. |
| 3 | 6,720 metres. | 720 metres, or $\frac{1}{9}$ of the number of the cubic metres representing the volume. | 112 metres, or $\frac{1}{60}$ of the number of the cubic metres representing the volume. |
| 4 | 31,400 metres. | 2000 metres, or $\frac{1}{16}$ of the number of the cubic metres representing the volume. | 314 metres, or $\frac{1}{100}$ of the number of the cubic metres representing the volume. |

* Each cubic metre contained in the gas-holder represents the ascension force of about 1 kilogramme (2 lbs.).

This is to say, that with aerostats of the dimensions just cited the surfaces opposed to the air corresponding to each kilogramme of ascensional power will be as follows:—

| The Numbers. | Lateral Surface in Square Metres. | Fronting Surface in Square Metres. |
|---|---|---|
| For Number 1, it will be | 1·1250 metres. | 0·2000 metres, or $\frac{1}{5}$ of a square metre. |
| For Number 2, it will be | 0·3200 metres, or $\frac{1}{3}$ (about) of a square metre. | 0·0500 metres, or $\frac{1}{20}$ ,, |
| For Number 3, it will be | 0·1071 metres, or $\frac{1}{9}$ ,, | 0·0166 metres, or $\frac{1}{60}$ ,, |
| For Number 4, it will be | 0·0636 metres, or $\frac{1}{15}$ ,, | 0·0100 metres, or $\frac{1}{100}$ ,, |

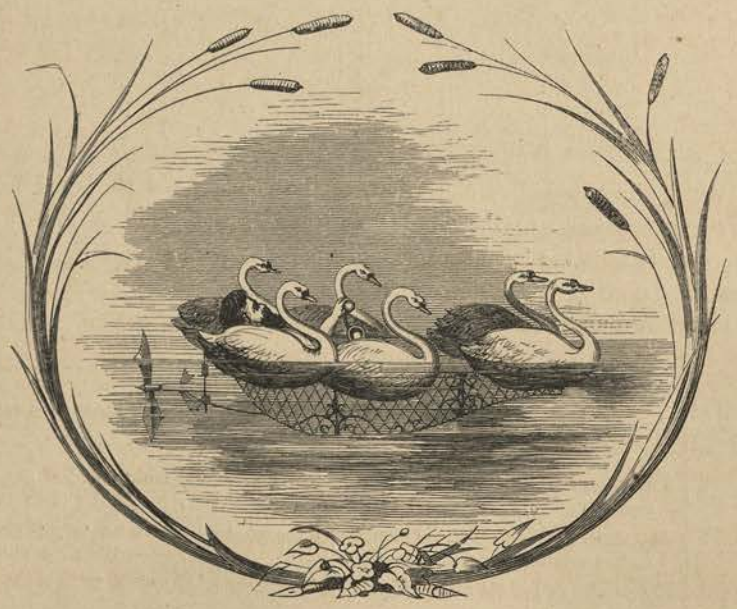
Do not these figures speak for themselves, and show clearly the superiority of large over small aerostats?

The reader will therefore understand the importance of this point for aerostation in general. All doubts must give way before the simple facts we have related. Whatever care is taken to guard against thoughtless and immoderate enthusiasm, one cannot but acknowledge the aeronautics just propounded, more particularly from the development of which it is susceptible, embraces all the elements of success.

M. David says that a satisfactory trial of this system would only cost 2000*l.*

I have not yet seen any mention of a very simple locomotive power peculiarly adapted to aerostation, and suggested to me by an inventive farmer named Birt, who lives at Otterburn, near Winchester. It is to construct clockwork machinery that is set in motion by a weight. The ballast of the aeronaut or the cargo of a ship might be so balanced as to effect this.

M. Arthur Mangin, in his beautiful volume entitled 'L'Air et le Monde Aerien,' 1865, gives his opinion in favour of some bird-like machine, and cannot possibly conceive the successful direction of a balloon of any form; as he maintains "that a body must be always more dense than the medium through which it has to move."



Dessen's Bath.

# CHAPTER X.

FEELINGS EXPERIENCED IN AERIAL TRAVELLING IN CALM AND STORM.

## THE SKIES.

Ay! gloriously thou standest there,
  Beautiful, boundless firmament!
That, swelling wide o'er earth and air,
  And round the horizon bent.
With thy bright vault, and sapphire wall,
Dost overhang and circle all.

Far, far below thee, tall old trees
  Arise, and piles built up of old,
And hills, whose ancient summits freeze
  In the fierce light and cold.
The eagle soars his utmost height,
Yet far thou stretchest o'er his flight.

Thou hast thy frowns—with thee on high
  The storm has made his airy seat,
Beyond that soft blue curtain lie
  His stores of hail and sleet.
Thence the consuming lightnings break,
There the strong hurricanes awake.

Yet art thou prodigal of smiles—
  Smiles, sweeter than thy frowns are stern:
Earth sends, from all her thousand isles,
  A shout at thy return.
The glory that comes down from thee,
Bathes, in deep joy, the land and sea.

The sun, the gorgeous sun is thine,
  The pomp that brings and shuts the day,
The clouds that round him change and shine,
  The airs that fan his way.
Thence look the thoughtful stars, and there
The meek moon walks the silent air.

The sunny Italy may boast
  The beauteous tints that flush her skies,
And lovely, round the Grecian coast,
  May thy blue pillars rise.
I only know how fair they stand
Around my own beloved land.

And they are fair—a charm is theirs,
  That earth, the proud green earth, has not,
With all the forms, and hues, and airs,
  That haunt her sweetest spot.
We gaze upon thy calm pure sphere,
And read of Heaven's eternal year.

Oh, when, amid the throng of men,
  The heart grows sick of hollow mirth,
How willingly we turn us then
  Away from this cold earth,
And look into thy azure breast,
For seats of innocence and rest!

BRYANT.

THE FRESHMAN — THE SENSES DECEIVED — FLYING OFF AT A TANGENT — "THE TORNADO WILL NOT EXTINGUISH A CANDLE" — "A FRESHMAN INSENSIBLE TO THE CHARMS OF HIS SITUATION" — THE TRANSLATION — THE UNSEEN MOST VISIBLE — THE REMARKABLE CLEARNESS OF OUTLINE — TRANQUILLITY OF MIND — THE REASON FOR AN ABSENCE OF GIDDINESS — THE CLOUDS — TWO STRATA OF CLOUDS — COLOURS AND SOUNDS — THE BOUNDLESS ABYSS — GRAVITATION — FLOATING ON THE SEA ALONE AND FAR FROM SHORE, A SENSATION SIMILAR TO A SOLITARY ASCENT — THE VIBRATIONS OF SOUND — THE ZENITH OF PRUSSIAN BLUE — THE DIFFUSION OF LIGHT — "THE STARS APPEAR IN THE DAY AS THEY DO FROM THE BOTTOM OF A WELL" — REFLECTED HEAT FROM THE CLOUDS — "THE LINE OF PERPETUAL SNOW" — "CONCAVE APPEARANCE OF THE EARTH" — THE DESCENT — SKILL REQUIRED BY THE AERONAUT — MR. GREEN'S SUCCESS AN INSTANCE — "SINGING IN THE EARS" — OXYGEN — SONG OF THE STARS — "THE CONTRASTS" — A CLOUDSCAPE — A PARHELION — "FALLING ON ONE'S FEET" — MIDNIGHT — FALLING INTO THE ADRIATIC SEA — WET CLOTHES FROZEN ABOVE THE CLOUDS — "PICKED UP BY A SMACK" — COUNT ZAMBECCARI'S DEATH IN 1812 — A VISION — "A JOURNEY SIX MILES HIGH" — "THE SIGHT OF 130,000 SQUARE MILES" — "SAND ENOUGH AND TO SPARE."

I BEGIN this chapter by again citing Mr. Monck Mason, as he is one of the ablest writers on the subject. This forms part of an appendix to the description of his voyage in the "Great Nassau" balloon:—

SUMMARY OF THE VARIOUS PHENOMENA OBSERVABLE IN THE PRACTICE OF AEROSTATION.

The conveyance through the atmosphere by means of the balloon is a thing so entirely *sui generis*, so essentially distinct in all its bearings from every other process with which we are acquainted, that no force of

reasoning is of itself capable of awakening in the mind of an utter stranger to the art, any adequate notion of the peculiar phenomena which characterise this novel and interesting mode of transport. So devoid, indeed, may it be said to be of any of those analogies which in other matters serve to supply the place of actual experiment in determining the general results of new and untried combinations, that I am convinced if an individual were to set himself down with the intention of endeavouring to picture in his imagination the various circumstances and impressions which develop themselves in the practice of aerostation, with all the advantages which a thorough knowledge of the arts and sciences in general could contribute to his assistance, he would still arrive but at a very rough and imperfect representation of the real nature of the case in question. With so few opportunities of forming a more correct estimate by personal experience, it is not to be wondered at should much ignorance be found to prevail upon this head, even amongst those who seem at least to take the strongest interest in its details.

Much of this obscurity, it is true, might have been removed, and the mysteries of the art brought within the reach of ordinary inquirers, had the experience of others been but turned to its proper account, and rendered available to the purposes of general information.

The first thing, then, which strikes the incipient aeronaut in the outset of his career is the sense of extraordinary quiescence which immediately ensues upon the dismissal of the machine from the ground. No matter how agitated the balloon before its departure, no matter how violent the circumstances under which the ascent is effected, the moment the last hold upon the solid earth is cast off, all is perfect repose and stillness the most profound. The creaking of the car, the rustling of the silk, the heavy lurching of the distended sphere swayed to and fro by the breeze, and shifting its load with sudden and energetic motion, despite the efforts of the individuals who are struggling to retain it, all have ceased in an instant, and are succeeded by a degree of tranquillity so intense, as for a moment to absorb all other considerations, and almost confuse the mind of the voyager from the suddenness of the change, and its apparent incompatibility with the nature of the enterprise in which he is embarked.

Unprepared for such a result, or occupied perhaps in other reflections, the unpractised tyro is seldom in fact conscious of the exact moment of his departure, and instances are not infrequent in which the aeronaut has been so far deceived by the unexpected serenity of the situation as to have been transported to a very considerable elevation, without being aware that the act of separation had been effected, until it became forced upon his notice by the fast fading voices of the assembled populace cheering his ascent.*

Recalled to the knowledge of his situation, a sudden and most natural impulse at first leads the aeronaut to look forward; nothing however appearing in the direction in which habit has almost unconsciously impelled him to direct his gaze, his eye insensibly assumes a downward course, and he becomes at once assailed with a mass of observations and reflections, among which, astonishment at the unusual tranquillity that accompanies alterations so rapid and so remarkable, is one of the most prominent. Without an effort on the part of the individual, or apparently on that of the machine in which he is seated, the whole face of nature seems to be undergoing some violent and inexplicable transformation. Insensible of motion from any direct impression on himself, and beholding the fast retreating forms, the rapidly diminishing size of all those objects which so lately were by his side, an idea, almost amounting to conviction, involuntarily seizes upon his mind, that the earth with all its inhabitants had, by some unaccountable effort of nature, been suddenly precipitated from its hold, and was in the act of slipping away from beneath his feet into the murky recesses of some unfathomable abyss below. Everything in fact but himself seems to have been suddenly endowed with motion, and in the confusion of the moment, the novelty of his situation, and the rapidity of his ascent, he almost feels as if, the usual community of sentiment between his mind and body having been dissolved, the former alone retained the consciousness of motion, whereof the latter had by some extraordinay interference been suddenly and unaccountably deprived.

Although the absence of all the ordinary effects of motion upon the human frame continues to mark the

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* A remarkable instance of this occurred to Mr. Charles Green in his first ascent, which took place on the occasion of the coronation of His Majesty George IV. Oppressed with the heat of the day and the fatigue he had previously encountered, as he sat in the car waiting the sound of the gun that was to indicate the moment of his departure, he requested his friends who were holding the balloon to allow it to raise itself a little, that he might enjoy the fresh air above the heads of the crowd that hemmed him in on all sides. In endeavouring to comply with his request the assistants accidentally let the cords slip from their hands. Disengaged from its hold, the balloon immediately and rapidly commenced its ascent, without the slightest knowledge on the part of Mr. Green, who had just sat down to repose himself, and had actually reached a considerable elevation ere he was made sensible of the fact by hearing the united shouting of the multitude, accompanied by the expected discharge of the cannon, which almost miraculously took place in the same instant.

progress of the aeronaut at all elevations, and throughout the whole of his career, the peculiarity of his situation in that respect is never so forcibly urged upon his notice as in the commencement of the ascent (when the contrast between his late and present condition is freshest in his mind), and, though in a slighter degree, during those depressions which occasionally take place in the course of the voyage, when the balloon happens to be brought into closer contact with the surface of the earth beneath.

I have already adverted to the peculiarly delightful sensations that attend upon such situations, and among them have remarked as by no means the least striking, those which arise from the consciousness of rapid motion, unattended by those effects by which, in all other circumstances, it is ever known to be distinguished. No part, in fact, of the whole career of the aeronaut bears so strong a resemblance to flight, or more truly appears to realise the sensations we sometimes experience in our dreams, when elevated in fancy to the enjoyment of that delicious occupation. Here it is that the reality of the case is most strongly forced upon his notice, and the mind awakened by all the various symptoms of the rapid progression of the atmospheric current in which he floats—the sounds of its resistance, issuing as it were out of the very bowels of the earth—the agitation of the trees—the varying tints of the upper surface of the woods and meadows as they bend simultaneously beneath the blast—the rapid retrocession of all the known fixed and stable objects upon the plain beneath—together with the ever-changing features of the scene; all indications undeniable of the reality of his progress, which every foot he recedes from the vicinity of the earth only tends to weaken and impair. Truly conscious of his motion, here it is that he is most strongly impressed with the absence of its ordinary effects, and *feels* the novelty and delight of a situation which in no other manner can he ever be made to experience. As he rises this feeling disappears, and he ceases to derive any extraordinary impression from the peculiarity of his situation, because, not being made sensible of the real state of the case from observation and reflection, he perceives no reason to suspect that there is motion, and consequently suffers no peculiar sensation or surprise from the absence of its ordinary effects.

That the body should thus, in a manner, be insensible to the effects of motion in a balloon, will not, perhaps, be deemed so surprising when we come to consider what are the means by which alone these effects are in ordinary cases made apparent to the human frame. As this is a new field of inquiry, for aught that I am aware of, the reader will excuse our taking a more minute review of it than, under other circumstances, we should perhaps feel ourselves authorised in hazarding.

In the pursuance of this inquiry, then, it is necessary to be observed, that the human body is composed of a variety of different materials, of different specific gravities, and endowed with different degrees of sensibility to pressure, or other disturbing causes, to which they may happen to be subjected. When these are set in motion all together, by one and the same impelling force, a very considerable disarrangement of their relative positions must ensue, or else a proportionably great resistance to that disarrangement, where the parts are so circumstanced as not to be able to change their position in obedience to the general impulse.

To make this clearer by an example: if a tray containing a variety of different sized globules of lead or other heavy material, varying in dimensions from a grain of sand to a four-pounder, be placed at one end of a long table or board fixed horizontally, and with a sudden motion be made to slide forward towards the other, a marked difference will immediately take place in their relative positions from that in which they were placed at first. The larger and heavier balls, unable to acquire the same rate of motion, in the same space of time, and through the medium of the same impulse, will immediately fall a little behind the others, and all, more or less in proportion to their particular *vis inertiæ*, suffer a retrocession or loss of place, owing to the suddenness wherewith the first principles of motion had been attempted to be communicated to them. Were these objects so disposed as not to be able to display the influence of the sudden acquirement of motion, by a change of place (as for instance, if they were all connected together by elastic ligatures, or imbedded in glutinous strata), the motion thus impeded would necessarily resolve itself into a reaction among the parts, producing unequal degrees of pressure, or communicating unequal shocks (where any liberty for motion was allowed) to the adjacent portions of the medium in which they were located. Now, this is exactly the situation in which the parts of the human body exist, and which we have sought to represent in the previous example, by the more familiar illustration of the leaden globules.* Prevented by their structure and combination from following the course they would

* The reason for our selecting that material as an agent in the experiment is merely on account of its weight, to avoid as much as possible the influence of the resistance of the atmosphere in checking the tendencies of the different objects to follow the course pointed out for them by the laws of projectiles. In the application of the example to the human body no such consideration is required, as all the parts united in one common mass are by their nature protected from all such interference, except upon their external surface; and even from that they are, by the peculiar characteristics of the art, exempt in the process of aerostation.

assume, if allowed to act in obedience to the laws of motion, all the motive energy with which they have been endowed is necessarily resolved into reaction, and being various in amount and variously exerted, produces a disagreeable pressure or tendency to disturbance of the condition in which the parts naturally exist when in a state of repose.

To this disturbance, then, I am inclined to attribute the production of the sense of motion in the human frame, which may thus be considered as merely a new mode of operation in the sense of feeling, or rather perhaps of that sixth sense discovered by our celebrated physiologist Sir Charles Bell, by means of which the mind takes cognizance of the relative positions of the different parts of the body without the instrumentality of the organs of sight or feeling.

Now we learn by the laws of dynamics that all bodies, without regard to their specific gravities, move with equal velocities under the same active impulse in an unresisting medium;* the only difference observable in their conduct being in the length of time required ere their powers of passive resistance be overcome, and they be brought to display the whole result of the motive force applied; as may be seen upon reference to the experiment which we have already adduced in illustration of the subject; wherein, after the first derangement of the relative positions of the objects on the tray, occasioned by the first induction of motion, no further derangement will be observable so long as the rate at which they are propelled remains the same. As it is upon this derangement alone that depends the sense of motion, one point in the train of consequences then becomes established, namely, that no sensation will be awakened in any individual so long as the motion to which he is subjected is uniform.

Again, were those changes of motion (to which we have above alluded as being the only causes of the derangements that awaken the sense of motion) to take place in such a manner as not to be productive of those derangements, then would the epochs of those changes, like the others, fail in being noticed, and the whole career of the individual, however varied, pass without the slightest consciousness of motion on his part. To this effect all that is requisite is the observance of a certain rate in the induction of those changes, whereby the *vires inertiæ* of the different parts are overcome, and all are made to commence their career of equal motion at the same time. By a slow and gradual process alone this may be accomplished; for, however there is a limit to the quickness with which bodies will take upon themselves a given state of motion, there is no such limit in the opposite direction; if you proceed to invest two unequal bodies with equal motions *too rapidly*, you will disturb their relative positions by investing the lighter with the full amount of motion, before you have entirely overcome the passive resistance of the heavier; but if you proceed ever so *slowly* to the same end, you will never produce a derangement of their relative positions by investing either with the full amount of motion before the other. Accordingly, to resort once more to our favourite illustration, if the tray of objects above mentioned were to be advanced gradually and with proper regard to their several exigencies, the utmost conceivable rate of motion might be obtained, preserved, altered, abolished, and renewed *ad infinitum* without the slightest derangement in the relative position of the different component parts. It is almost unnecessary to add that were an individual placed in the same circumstances, the different parts of his body would observe the same laws and exhibit the same result; the consequence of which is, that under such circumstances, the sense of motion would not be awakened at all, and the irregular as the uniform progression pass equally unheeded and unknown.†

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* Although a vacuum and an unresisting medium are not exactly the same thing, yet as regards their influence in the laws of motion they may be considered as similar. The different internal parts of the human frame, for instance, are not seated *in vacuis* yet the influence which the medium wherein they are situated exerts upon them disappears when *fairly* in motion, all the parts observing the same rate, and therefore affording no grounds for interference.

† The adoption of the preceding theory of the sense of motion will, I believe, afford a clue to the solution of certain physiological phenomena which have long puzzled the world, and which, although not exactly pertaining to the present subject, yet, as being corroborative of the theory by which it is sought to be illustrated, we may perhaps be excused for noticing; I allude to the sickness experienced at sea, in the exercise of the swing, in the revolutions of the waltz, and other movements of a similar description, and productive of similar results. From what has been said above, we perceive that the sense of motion and its immediate cause, the derangement of parts, are not *always* attendant upon actual motion, but merely observable in consequence and during the continuance of certain interruptions. But the derangements alluded to, and consequently the sense of motion to which they give rise, are not capable of being excited to a very high pitch of energy by every species of interruption which may occur to call them into action. From the very nature of the construction of the human frame, these derangements of the parts can never, without actual organic lesion, take place to any very considerable extent; and consequently the sense of motion, as we really find to be the case, cannot be capable of great intensity. Like many other corporeal (and indeed all mental) impressions, however, the deficiency in intensity of action may be amply supplied by the protracted continuance of its effects: as an illustration of which in analogous cases, I need only cite the action of most medicines—for instance, that of the emetic principle upon the stomach, which, unaltered in its intensity, does not begin to act until the parts have for some time been subjected to its influence. In the same manner the derangements which give rise to the sense of motion may be, and frequently are, by the increased duration of their action, brought to exhibit very powerful and impressive consequences. To produce that increased duration of action, it is necessary that the sense of

Now this is exactly the situation in which the aeronaut is placed. From the moment the balloon quits the ground until its return to earth again, nothing ever befalls (except from accidental collision), which can or does produce a change of motion sufficiently rapid to awaken the perception of his progress. Changes, it is true, do occur both in the rate and direction of his course. Alterations in his elevation are continually taking place with more or less rapidity, which occasionally require to be checked with considerable promptitude by a liberal discharge of gas and ballast; a few seconds are frequently sufficient to make a difference of some thousand feet in the level of his course; yet the changes, striking as they may be, are never accomplished with that degree of impetuosity which is necessary to awaken a sensation of their effects. Currents also of different velocities and different bearings are also constantly encountered. But the mutual action of currents of air is never sudden: their bounds are not fixed by certain lines, like those of the more solid substances, nor are the changes which may take place in them, even though conducing to direct opposition, ever so decidedly marked and promptly executed as to lead to a sensible perception of their results.

Debarred, therefore, in every way from obtaining a direct personal feeling of his progress, it is only by a comparison with the phenomena presented by known fixed objects that the aeronaut can even ascertain the fact, whether he is really in a state of quiescence or of motion. This is an intelligence which his sensations alone are incapable of supplying; it is to his judgment, with the assistance of his sight, that he is forced to look for the solution of the question. Where the exercise of that organ is denied him, as at night, during the prevalence of fogs, where clouds intercept his view, or the uniformity of the subjacent surface leaves him no sufficiently distinct object to refer to, as over a broad expanse of ocean, the rate of his progress, nay, its very existence, is to him a secret not to be unravelled, except by the aid of such a mechanical connexion with the earth as in his ingenuity he is able to devise. Such a connexion is that which is formed by means of the guide-rope; and the indications it affords of the rate and direction of the balloon, I consider not the least valuable property of that ingenious instrument.

The next striking circumstance in the order of succession, distinctive of the present subject, is the sudden cessation and continued absence of all atmospheric resistance, the presence of which one is apt to consider so essential a concomitant of locomotion, especially when conducted with any unusual degree of speed. Acting in conjunction with the preceding, the influence of this novel characteristic upon the mind and senses of the inexperienced aeronaut in the commencement of his career is truly magical; more especially if the state of the weather at the time be such as to afford room for the establishment of a sufficient contrast. Suddenly subsiding the instant the act of liberation has been effected, all the various symptoms of violent atmospheric commotion, by which his previous situation was so notably distinguished, simultaneously disappear; the heaving of the balloon, the sighing of the wind through the cordage, the flapping of the silk above his head, the wonted action of the passing breeze upon his own person, everything, in short, which can bear testimony to the exertions of the element and the force by which it is with difficulty resisted, at once becomes completely at rest: not a motion is felt, not a breath of wind is perceptible; the balloon, as if arrested by the influence of some powerful

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motion be supported by a course of interruptions, occurring at such intervals as will not allow the parts to recover from the effects of one deranging influence before they have been subjected to another. That this is the case as regards alternating motions—those, for instance, by which sea-sickness is produced—does not require to be illustrated; the interruptions, by means of which the sense of motion is maintained, are here sufficiently palpable. With respect to rotatory motion, however, the action of the deranging causes may not perhaps be quite so evident. Nevertheless, though more obscure, they are not less decided, and, if anything, still more energetic in their effects. As all bodies in motion, when uninfluenced by disturbing causes, tend to proceed in right lines, the motion of bodies conveyed in the direction of a curve may be considered as really compounded of incessant interruption to the rectilinear course which the laws of nature incline them to pursue. So far, therefore, from being exempt from disturbance by the apparent equability of their motions, the parts of a body revolving round a centre are even still more incessantly liable to the deranging agency than where they are absolutely made to alternate, even with violence, between two extremes in opposite directions.

To the *protracted duration of the sense of motion, then*, I am inclined to attribute all those cases where distressing symptoms follow the infliction of certain movements. To this supposition all the phenomena are reconcilable. Here we see the reason why a heavy lurching motion—the heaving of a ship at sea, for instance, but still more the rotatory motion (in which the disturbing influence is not only *protracted*, but *incessant*) is always attended by greater distress than a short, quick, alternating motion, however long continued, where the impetus of the parts becomes arrested before they have experienced the full amount of disturbance, and where, constantly oscillating on either side of their natural condition, they are never either *long* or *far* from the means of recovery. We also see the reason why in a rotatory movement the larger the circle in which the parts are conveyed, the less the distress; the tangent in which they tend to fly off more nearly coinciding with the segment of the curve in which they are detained. Thus, revolving rapidly on one foot, after the manner of the pirouette, is quicker in inducing nausea than performing the gyration in a larger space, to those who are unused to either. The manner also in which *habit* enables the individual to withstand the effects of the motions is also strongly in accordance with the principles of the above explanation, and might be illustrated by many analogies with other physical impressions.

and invisible agent, suddenly assumes an upright posture, and stands, as it were, fixed, rigid, and immovable, while the mind of the adventurer, unconscious of all but the change itself, becomes struck with the awful conviction that some extraordinary revulsion has just taken place, whereby the raging elements have been suddenly tempered into tranquillity, and an universal and unnatural calm induced upon the previously disturbed condition of the mighty powers of nature.

From this time forward, until the conclusion of his flight, the same impressions continue to accompany the progress of the aerial voyager, weakened only in their energy (like, indeed, almost all those peculiar to the practice of this art) as, increasing his altitude, he diminishes his relations with the earth, and with them the grounds of comparison, whereby alone he obtains a consciousness of the real circumstances of the case, and is made to *feel* the absence of results, which are in fact only remarkable when missed, and only missed when particularly expected.

So long as the balloon is left free to pursue her own course upon the same level, unaffected by any of those excessive variations in her buoyancy, which impress upon her a rapid motion, apart from that of the current in which she floats (as when she ascends or descends at the commencement or conclusion of her career, or by the sudden loss of any serious amount of gas or ballast during its continuance), this state of things remains uninterrupted, admits of no qualifications, and is liable to no exceptions. Totally independent of the rate or direction of the current, it remains equally absolute whether the actual progress of the balloon be one, or one hundred miles an hour—whether it be on one continued line or subject to the most rapid and incessant variation. The greatest storm that ever racked the face of nature is, in respect of its influence upon this condition of the balloon, as utterly powerless and inefficient as the most unruffled calm, the most unequivocal repose. To such an extent is this the case, so truly indeed is atmospheric resistance a nullity to the aeronaut, that were we to suppose him (by way of illustration), suddenly transported to the West Indies, the birthplace and habitation of the tornado and the hurricane, traversing the skies at a time when one of the wildest and fiercest was exercising its utmost powers of devastation, looking down from his air-borne car and beholding houses levelled, trees uprooted, rocks translated from their stony beds and hurled into the sea, earth and ocean in mutual aggression encroaching upon each other's limits, and all the various signs of desolation by which its merciless path is marked, he might nevertheless hold in his hand a lighted taper without extinguishing the flame, or even indicating by its inclination to one side or the other the direction of the mighty agent by which such awful ravages had been created. No sooner, however, has the grapnel touched the ground, and the slightest opposition been afforded to the progress of the balloon, than all this seeming tranquillity is at an end, and the aeronaut for the first time becomes sensible in his own person of the real influence of that mighty element, of whose presence and power he had hitherto been able to judge through the medium of his sight alone.

The theory, by means of which the non-resistance of the atmosphere in aerial navigation is accounted for, is by no means so complex as that by which it was found necessary to illustrate the previous characteristic phenomenon of the absence of the sense of motion. Floating in and by means of the action of the air itself, no difference can, in fact, ever exist between the rate of the machine and that of the medium of its conveyance (after the first efforts to overcome the *vis inertiæ* of the former have been successfully exerted), so long as both remain at liberty to obey the course dictated by the laws which govern the motion of bodies in a fluid medium. Strictly observing the same reciprocal positions throughout the whole of their progress, no retardation or acceleration of the course of the one beyond that of the other exists, whereby a resistance could be created. To all intents and purposes, therefore, a balloon freely poised in the atmosphere may be considered as absolutely enclosed or imbedded in a box of air; so completely so, that (for example) were it possible to distinguish, by tinging it with some particular colour, that portion of the atmosphere immediately surrounding the balloon, and in that guise commit her to the discretion of the elements, she would, apart from all fluctuations in the level of her course, continue to bear the same tinted medium along with her, even until having completed in her course the circumference of the globe, she had, the winds permitting, returned to the same spot from which she had originally departed.

As a general rule, however, it is to be observed, that this characteristic discontinuance of atmospheric resistance only holds good as regards the horizontal or *passive* progress of the balloon. With respect to its vertical, or as it may be termed, its *active* motion, that in short which proceeds from the exercise of its own buoyancy, some deviation from that state of perfect atmospheric repose will no doubt be occasionally discernible, especially when the movements alluded to are accomplished with any considerable degree of rapidity. Upon the principle of this resistance, various attempts have been made to construct instruments to supersede the barometer, in affording

indications of these movements, and of the rate at which they are effected; hitherto, however, it must be confessed without any satisfactory result. The generality of the changes are, in fact, much too slowly conducted to afford grounds for the establishment of a resistance sufficient to overcome the obstacles offered by the *vis inertiæ*, friction, defective construction, and "the thousand natural ills which *art* is heir to," and from which no species of instrument, however delicate, which depends on mechanical action for its results, is entirely exempt.*

From what has been before stated, the futility of any attempt to apply this principle to the ascertainment of the horizontal motion of the balloon, either by means of instruments especially constructed, or by observations drawn from the difference between the rate of motion of the balloon itself, and that of light bodies (as tissue paper, for instance) purposely thrown over, is placed beyond a doubt. No such difference, in fact, occasioned either by the detachment of the body or its different specific gravity at all exists: where any such is perceivable, or thought to be perceivable, it may at once be laid to the account of some peculiarity in its form, or otherwise in the direction first impressed upon it, and which, in the course it induces it to assume, is as likely to have acted in opposition to, as in concert with the direction of the current at the time prevailing.

Bound, of course, by the same rule, all clouds occupying the region of the same current in which the course of the balloon happens to be conducted, must ever continue to observe the same distances from that object as they held at the commencement. It is true that internal changes of form and position may at all times be discerned between the different parts of the same vapoury stratum, by any one who will take the trouble to examine their progress attentively for a few minutes. Without, however, infringing upon the generality of the proposition here laid down, such alterations of form and position are amply accountable for on the score of temperature, electrical affinity, and a variety of other specific influences; either through their direct effects upon the forms and dimensions of the aqueous masses (and be it observed that a change in form is, in fact, a change of position too), or by reason of the variations they work in the actual densities of the different parts, whereby their existing momenta become altered, and a temporary interruption occasioned in the equability which (with such exceptions) characterises their motions, as that of all other bodies, in an unresisting medium.

The entrance therefore into clouds, and the exit from the same, can never take place without a change of altitude on the part of the aeronautical machine; an observation which may give some satisfaction to those who rate highly the danger of coming in contact with clouds charged with electric matter, or entertain a fear of being overtaken by bad weather in the course of their excursions.

One other consequence of the absence of atmospheric resistance remains to be noticed; I mean its influence in mitigating the effects of a low temperature upon the human frame, and rendering regions not only habitable but even delightful, which, but for this modification could never be entered without pain nor endured without danger. In a previous narrative I have already adverted to this circumstance, and noticed the beneficial consequences that resulted to us from it during a night and a voyage of otherwise insufferable rigour. In further illustration of the effects of that peculiarity to which I have attributed the exemption we experienced from the ordinary consequences of a low temperature, I have merely to add that the only periods when the actual temperature pressed severely upon our feelings were, when in ascending or descending rapidly, as occurred to us occasionally during the night, a motion and resistance were occasioned in the air, such as I have just mentioned to be the only exceptions to that general state of atmospheric stillness which otherwise never ceases to distinguish the progress of the balloon in her career.

To return to the aeronaut whom we left some pages back in the act of commencing his ascent, the reader must not suppose that all the circumstances and impressions which we have here detailed as consequent upon the change which the liberation of the balloon is calculated to make in his situation, or the same process of reasoning

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* The best of these attempts which I have seen is undoubtedly that of Mr. F. Gye, jun. (son to the proprietor of the balloon in which the late expedition was accomplished), upon the principle of an extremely light wheel adapted with vanes, like the paddles of a steamboat, and enclosed in a box partly open at top and bottom to admit the action of the air in ascending or descending. To the above is attached a rotary index, serving to denote by the velocity and course of its gyrations the rate and direction of the machine *in transitu*. Although the result of the trial to which it was submitted in our excursion was not perfectly satisfactory, it is but just to observe, that the fault was more attributable to the defects of the particular instrument than to the principle of the contrivance —its size being too limited to take in a sufficient portion of the atmosphere, while at the same time it was not sufficiently protected by the form of its receptacle from the influence of the counter-currents occasioned by the motions of the larger body in its vicinity, whereby its action in the former case was impaired, in the latter, deranged. With a due consideration of these defects, the result would, I have no doubt, have been more favourable, though never to such an extent as to enable it to supply the place of the barometer.

by which we have found it necessary to explain them, are either adopted or even recognised by the individual at that particular epoch of his voyage. It is not, indeed, at the time, certainly not the *first* time of experiencing them, that the aeronaut ever becomes awake to the just amount of his feelings, or fully conscious of the real combinations to which they are to be attributed. Indeed, to arrive at the latter of these conditions, requires a course of analytic examination to which few persons have sufficient presence of mind, or rather *insensibility to the charms of their situation* to be able at such a moment to submit; and even were they so inclined, the celerity wherewith the first operations of the ascent are conducted, and the variety of the events and sentiments by which they are succeeded, are such as to leave no time for the consideration of any one in particular, unless to the utter exclusion of all the rest. It is by the frequent experience of the enjoyment alone, or the constant recurrence to it in after times, through the medium of the recollection, that a thorough knowledge is obtained of all its various peculiarities, the effects of which are much more generally experienced in the mass than in detail, and, by most persons at least, much more readily acknowledged than understood.

From commenting, therefore, upon the state of his own feelings, the attention of the aeronaut is early and forcibly recalled to a consideration of the "world without him," where, indeed, a new and fertile source of gratification awaits him, in the prospect which his increasing elevation has almost unconsciously presented to his view. No sooner, in fact, has he cleared the highest obstacles in his immediate vicinity, ere he finds himself, apparently, in the midst of his career, and hurried into the presence of all those objects which constitute alike the study and delight of the aerial voyager. Indeed, the celerity with which the translation is accomplished, and the curious conclusions to which it conduces in the mind of the beholder, are not the least striking circumstances of the whole proceedings. Springing as it were at a bound out of the very bowels of the earth, scarcely a second elapses ere the balloon, approaching to all appearance the very acmé of her ascent, has placed the astonished beholder in full view of the spectacle prepared for him; not as it were with one sudden stride, or at one unvarying velocity, but seemingly like a rocket shot from its frame, that with decreasing energy continues to mount, until, at length, its utmost force being spent, it appears to pause for an instant ere it turns to bend its downward course to earth again.

Such, in fact, is the impression which the circumstances of the case are most strongly calculated to produce upon his mind, and from which nothing but a perfect knowledge and firm conviction of the reality could effectually preserve him. Without the sense of motion to guide his judgment, the only opinion he can form of his ascent is necessarily, though unconsciously, drawn from a hasty consideration of the changes which it occasions in the aspect of the scene around him. Now, as by the nature of things, all these changes proceed with *rapidly diminishing* intensity, as the distance from the eye of the spectator becomes increased,* so under the same condition of removal must the sentiments of his progress in the mind of the aeronaut become continually impaired, until at last the alterations from distance having soon ceased to be appreciable, the sentiment of his removal, to the maintenance of which they alone had contributed, become alike rapidly extinct.

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* The linear dimensions of objects being determined by the angle under which they are seen, necessarily vary in the inverse ratio of their distances from the point of sight. By the same rule it follows, that the superficial dimensions, upon which their apparent sizes depend, must vary inversely as *the squares* of the distances from which they are beheld. Thus, a body seen from any given point would appear four times as great as if seen from twice the distance, nine times greater than it would appear from a distance of three times the amount, and sixteen times as great as if the eye beheld it from a position at four times the original distance.

If, in the place of the *proportionals* here employed to designate the progression of the apparent decrease at stated intervals, we were to substitute *absolute* numbers, and estimate the dimensions of the object as seen from a given altitude, say one hundred feet, at the value of one hundred and forty-four, were the eye of the spectator removed to twice the distance, or to an elevation of two hundred feet, the number which would represent its apparent magnitude would be but thirty-six, thus showing a difference of one hundred and eight degrees between the appearance presented by the same object at the two stations in favour of the former. Were, however, the eye to be still further removed, to an elevation of three hundred feet (being an increment *equal* to the previous one), the measure of its appearance would be sixteen, thus denoting a loss of only twenty degrees upon the second progression; while nine being the expression of its visual magnitude at the height of four hundred feet, would indicate a difference of only seven degrees lost during the process of its removal through a third interval, equal in amount to either of those which preceded it. In such a series as this it is unnecessary to observe that an elevation is very soon attained where the differences occasioned by equal increments of altitude become so minute as to be inappreciable by the ordinary exertions of the senses. Now, as the impression of his ascent in the mind of the aeronaut (deprived, as we have shown him to be, by the peculiar circumstances of the case, of all absolute sense of his translation) is entirely founded upon and regulated by these, the ocular effects of his removal, it follows that all personal knowledge of his ascent must rapidly and progressively become fainter, till at first hundreds and finally thousands of feet pass unnoticed, at least as far as the eye is capable of judging by a consideration of the altered aspect of the objects it surveys. Hence the difficulty of ascertaining the vertical direction of the balloon's course by the mere intervention of the sight alone, and the inestimable utility of the barometer in affording indications of the many changes which are constantly taking place in the level of her progress, and which, in default of such indications, would otherwise be unobserved, until perhaps too late to remedy them without inconvenience.

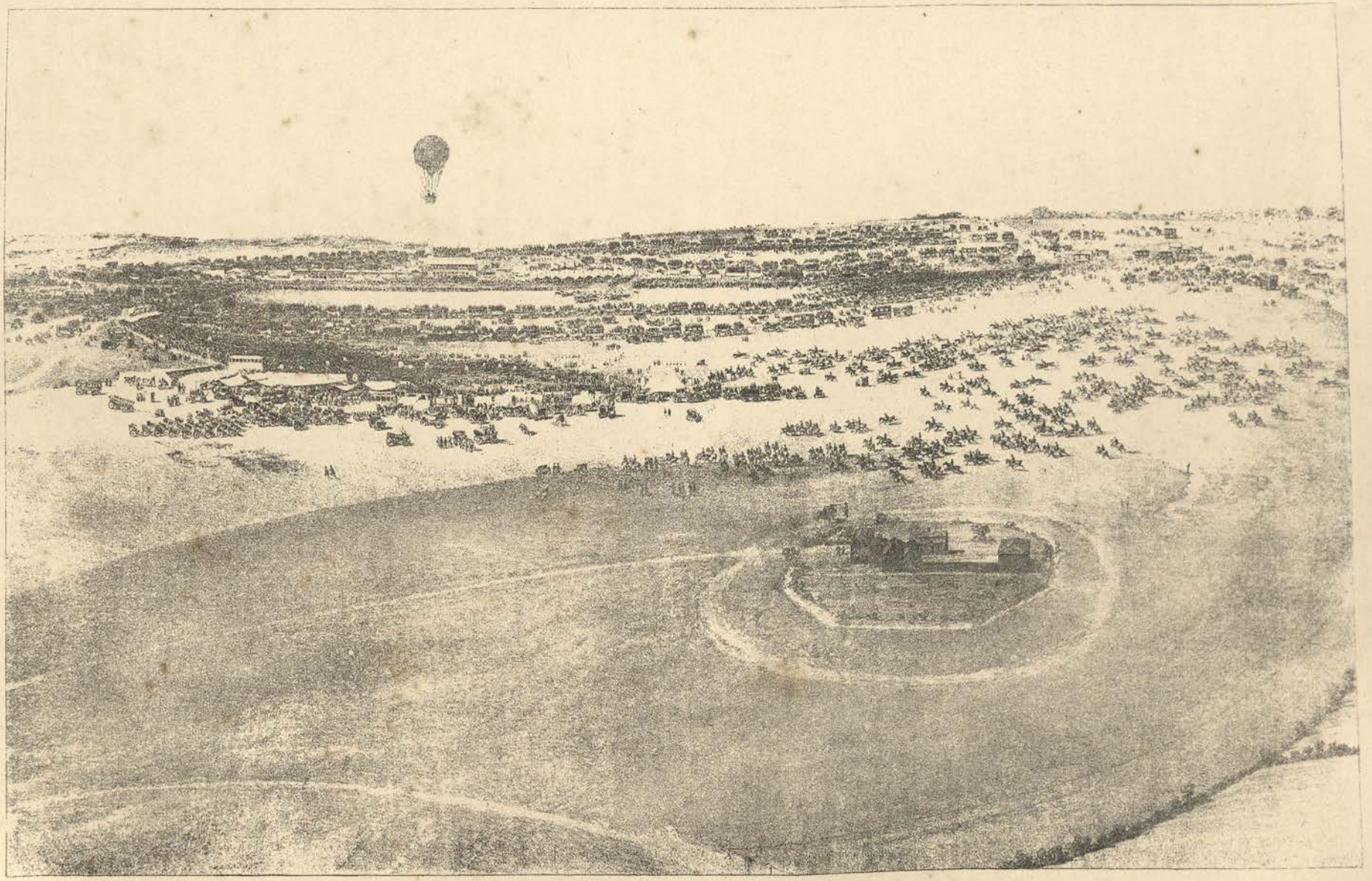

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Heldsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c Director.*

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The case is one to which nothing analogous exists in nature or can be created by the ordinary exertions of art; consequently the effects and impressions to which it gives rise are such as can never be experienced but in a like situation and under exactly similar circumstances. In no other manner is or can the individual be abstracted from the community with other objects of the same known appearances whereby to regulate his judgment and confirm his conclusions. The situation which approaches nearest to it in its conditions and effects is that of the mariner, when launching into the broad bosom of the ocean he looks back upon the shores he is quitting, and beholds them gradually disappearing in the obscurity of his increasing distance. Even here, however, the objects are necessarily so limited, and the first steps of the progression (in which the whole of the effect is concentrated) comparatively so slow, that the alterations produced are too few, and what there are of them too slight to afford grounds for the institution of a comparison between the two cases.

Under the impressions we have here feebly endeavoured to explain, and which time can neither obliterate nor practice entirely overcome, the aeronaut quits the earth to assume a station in the zenith of his own horizon. In a few seconds all those capital changes by which, as I have just stated, the first proceedings of the ascent are invariably accompanied, have subsided; and the prospect has become sufficiently composed to admit the minuter contemplation of its contents.

There projected upon a plane at right angles to his line of vision, the whole adjacent surface of the earth lies stretched beneath him, affording an heterogeneous display of matters at once the most interesting and incongruous. Distances which he was used to regard as important, contracted to a span; objects once imposing to him from their dimensions, dwindled into insignificance; localities which he never beheld or expected to behold at one and the same view, standing side by side in friendly juxtaposition; all the most striking productions of art, the most interesting varieties of nature, town and country, sea and land, mountains and plains, mixed up together in the one scene, appear before him as if suddenly called into existence by the magic virtues of some great enchanter's wand.

It is not, however, to the objects alone, magnificent and interesting as they may be justly deemed, so much as to the modifications they undergo from the unusual manner in which they are viewed, that is mainly attributable that peculiar effect by which the terrestrial landscape is so notably distinguished in the estimation of the aerial admirer. Seen, in the first place, from above, everything that meets his eye meets it under a novel aspect, and one which no other situation can in like manner and to the same extent enable him to enjoy. The summits of mountains, the tops of buildings, the upper surfaces of woods, those parts, in short, of all objects which by their natural or artificial positions have hitherto been excluded from his view, are now almost the only ones that come within the scope of his observations. Indeed I can hardly conceive a prospect more interesting, both from its novelty and the exquisite impressions to which it is calculated to give rise, than that which a richly wooded and irregular tract of country presents when examined from the car of a balloon, either suspended motionless or slowly advancing within a few yards from the level of its upper surface; such a scene and such a situation, for instance, as that enjoyed by us when we found ourselves unexpectedly becalmed above the woods, after our first ineffectual attempt to take the ground at the termination of the expedition, which forms the subject of the preceding narrative.

The large, rounded masses of soft, green foliage, following generally the character of the subjacent soil, here swelling into mounds, there subsiding into hollows, altogether presenting the aspect of a mighty sea of verdure; sometimes intersected with roads or paths; occasionally opening to expose small portions of the groundwork, patches of mould, or little recesses of a more sparing vegetation; flocks of birds roused from their engagements by the unwonted intrusion upon realms, hitherto entirely their own, flying from place to place in the vain hope of escape, first in a body, and finally, as the balloon tops the agitated community, breaking asunder and dispersing in every direction over the surface of the earth; the alternate approach and retreat of the beholder in connexion with the ground below, occasioned by the superior extaney of the hills, or the unusual depression of the valleys, introducing to parts otherwise inaccessible by human means; these and a thousand other circumstances and effects of minor note and less availing influence, combine to form a scene of enchantment in which the place of the sublime is amply supplied by that of the beautiful and the picturesque. Nor does it, perhaps, conduce least towards the general effect of such scenes, especially when viewed from a superior elevation, that all the objects of which they are composed are presented to the eye in the simplest manner possible as to their relative positions. None of the usual interference of parts, by means of which alone their different stations upon the same horizontal surface become

assignable, is here to be perceived; nor any of those apparent variations in their dimensions which mainly serve to indicate their progressive removal from the point of sight, when situated in or about the same line of visual observation. All the ordinary qualifications of such scenes become, in fact, annihilated, and the eye for the first time beholds a picture of nature on the vastest scale, both as to size and magnificence, in the construction of which none of the complicated laws of linear perspective are at all involved.

As the balloon continues to ascend, another scenic peculiarity begins to display itself in the vividness of contour, the remarkable sharpness of outline by which the different features in the terrestral prospect are qualified, and which, strengthening with the increasing distance, never forsakes them so long as the objects themselves continue to be distinguishable. The roads, rivers, canals, streets, buildings, enclosures, hedges, furrows, watercourses, and all the various characteristics of rural and artificial scenery, instead of appearing obscured and rendered more indistinct by their remotion from the point of sight, seem on the contrary to augment in clearness and decision, and absolutely gain in intensity what they lose in the magnitude of their proportions.

This singular property is attributable to two circumstances, the union of which is another peculiarity of the art we have taken upon us to illustrate, namely, an increase of distance between the objects and the spectator, attended by a corresponding decrease in the density of the medium through which they are beheld; whereby the minuter features of the lines by which they are bounded (and on which the irregularity of their appearance depends) are exclusively lost to view, the objects themselves remaining as clearly distinguishable as ever. The process by which this conclusion is attained is very simply explicable on the grounds of the difference between the optical effects of absolute *remotion* from the point of sight, and those of mere *obscuration* upon the visual condition of the material world. Although the end to which they both conduce may virtually be the same, namely, the exclusion of the object from the view, yet their modes of operation are extremely different, and during their continuance give rise to very different phenomena. The indistinctness which the increase of distance, *per se*, occasions in the aspect of an object, is the consequence of its apparent *diminution*; while that which proceeds from the obscuring tendency of the medium through which it is beheld, is the result of a *concealment*; more or less partial, in proportion to the density of the said medium or the quantity of it which intervenes. By the former, the objects or the parts of objects are abstracted from observation *in the order of their several sizes*; commencing with the smallest; by the latter, all are simultaneously and equally affected without regard to their dimensions. Now sharpness is a condition of the outline depending entirely upon the apparent absence of all parts bearing a small relative proportion to the whole; that which, therefore, removes from the sight such parts exclusively, conduces towards the production of the condition in question; and such an agent is distance, taken abstractedly.

An antagonist to this result under ordinary circumstances, however, exists in the general indistinctness which ensues upon the quantity of the atmospheric medium in its *greatest density*, which is made to intervene by the very act of removal; so that before the beholder has sufficiently increased his distance from the object to enable him to lose sight of its irregularities, either the object itself has entirely disappeared, or so forfeited its general character of distinctness that no definite outline can be at all perceived. From the influence of this interference, however, the aeronaut is to a considerable degree exempt; looking in the direction of the least atmospheric amount, he not only beholds everything through the smallest possible quantity of obstruction consistent with his distance, but keeps constantly adding to his advantages in respect of the former, the more he continues to amend his position in respect of the latter. If the reader has ever, during the prevalence of general fine weather, observed the aspect of some distant line of mountain, just before the occurrence of an unexpected shower, and noticed the peculiar clearness it appears on a sudden to have assumed, he will have witnessed a state of things similar to, though much weaker in their effects, than that which we have here attempted to describe; wherein the temporay rarefaction of the atmosphere (the ordinary precursor of rain) acts the part of the vertical elevation of the aeronaut in reducing the quantity of intervening medium, and in paving the way for a readier admission of the distance to perform its share of the effects before attributed to it.

As soon as the adventurer has sufficiently recovered from the influence of these, the first and most predominant impressions, to be able to direct his attention to the other peculiarities of his case, he becomes gradually struck with the extraordinary degree of ease wherewith he feels himself able to regard his situation, and the total absence of all those sensations of giddiness and mental anxiety which he has always felt and conceived inseparable from positions apparently analogous to that which he at present occupies. Instead of shuddering, as he might fairly be supposed inclined, at the prospect so unusually placed before him; instead of drawing back,

as it were, into himself to escape the full acknowledgment of the precariousness of his situation, he is astonished to find himself intently poring over the new leaf in the book of nature, which triumphant art has just enabled him to peruse, and far from trembling at its contents, enjoying in perfect tranquillity of mind the wonders it is continually unfolding to his view.

Nor is this a privilege by any means restricted to solitary cases, or dependent in any way upon the physical or mental constitution of the parties by whom it is experienced. All sorts of persons of every age and sex, and with every imaginable distinction of character endowed—the bold and the faint-hearted—the strong and the weak—the healthy and the infirm—equally concur in acknowledging the exemption; nor have I ever either met with or heard of any one of the numbers who have hitherto made practical trial of the fact, that ever complained of having been afflicted with the slightest giddiness or sense of personal anxiety from their exposure to a situation which, in the commencement at least, must have been equally unusual to them all.

From the earliest ages of the art, and even still (though owing to its more extended practice, in a less degree), this peculiar exemption has ever formed one of the sources from which the practical aeronaut has drawn most largely for his credit and estimation in the eyes of the unitiated and admiring public. And, indeed, where the real state of the case was confined to the bosoms of the few, and the world remained in ignorance of the fact that the situation in question was as perfectly exempt from all the causes, as it is from the effects of those sensations in apparently similar cases so alarmingly experienced, it is no wonder that men should visit with an extra degree of admiration those who were supposed exclusively to have had the courage to defy and the fortitude to resist the assaults of feelings which, in their real presence, prove superior to every exertion of human nature, and, unless when conquered by long habituation, subdue alike the powerful and the weak. A very pardonable desire to make the most of such a peculiarity, has accordingly induced many aeronauts to make their ascents under circumstances of exposure particularly calculated to enhance the apparent dangers of the case and afford room for the exercise of such apprehensions in their fullest force, were they at all capable of being felt in such situations. One of those, a French aeronaut, M. Mesment, was in the frequent habit of ascending upon a simple platform, entirely devoid of any defensive apparatus whatever—a practice in which he has been followed by many others, though happily for themselves, without experiencing so unfortunate a conclusion.

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Why the elevation to so unwonted an excess by means of the balloon should not be attended with, to say the least, an equal degree of giddiness to that experienced when standing upon an eminence on the immediate surface of the earth is a circumstance which has been much canvassed and variously accounted for. By the majority of those who have considered the matter, this singular privilege has been supposed to be owing to the want of a visible connexion between the earth and the balloon, whereby the eye is precluded from measuring mechanically, and the judgment from painfully criticising the altitude to which the individual has been raised. That the want of a connexion is the agent by which the result in question has been wrought, I have no doubt; as this, in fact, is the only characteristic distinction between the two situations; but that the mode in which it is said to operate is not the true one is pretty evident from the fact, that there are many situations which observe the same condition of a want of visible connexion with the earth, where the sensations in question are nevertheless found to prevail with unmitigated severity; as, for instance, in standing upon the summit of the monument of London, from whence all view of the pillar itself is excluded by the peculiar projection of the parapet; while on the other hand, situations fraught with an equal degree of apparent danger abound, in which the connexion in question is amply discernible, without in the least contributing to excite a sentiment of his danger in the mind of the individual exposed to it; as, for example, when he stands upon a narrow plank, or bridge, firmly extended between two perpendicular eminences, like that generally known as the "Pont du Diable," in Switzerland, and from which all apprehension of falling over has been removed by the presence of a sufficient protection in the form of a balustrade, or breastwork.*

From these examples, then, we clearly ascertain that the mere absence of a visible connexion is no

* Another proof of the influence of the condition of the fulcrum in modifying the sensations in question. The tranquillity experienced in the above situation is merely owing to the satisfaction in that respect which the support of the bridge at both ends is calculated to afford. Were the bridge a projection supported at one end only, there is no question that, however convinced of its security by an examination of the nature of the material, and its construction, the full force of the sensations in question would be experienced, in despite of the sense of protection which the balustrade is otherwise competent to produce.

more available to prevent, than its presence is to occasion, the production of the sensations alluded to, in circumstances otherwise calculated to encourage or suppress them. But the truth is, that the mental process of comparison, to the want of which the aeronaut is supposed to be indebted for his especial freedom from personal alarm, can have really little or nothing to do with the condition of his case in that particular. It is not, by any means, in proportion to his elevation that the sensations in question display themselves; nor indeed beyond a certain point does it seem to operate at all: the same impressions being consequent upon a station on the top of an ordinary house of five stories, and one upon the summit of the cupola of St. Paul's Cathedral, so far at least as the question of altitude is concerned. All that is required is, that the distance be such as to satisfy the mind that vital injury would accrue from the fall were it to occur. Now *that* knowledge it obtains without the aid of any visible communication with the earth; consequently it could never owe its exemption from the sensation in question to the want of a condition, of which if it were present it would never have availed itself.

The process, therefore, by means of which the deficiency of connexion in the case before us conduces to the admitted result, is unquestionably different, and the difference I take to consist in the light in which it disposes the mind to regard the security of the sustaining power. In all situations in which grounds of apprehension exist, and the apprehensions themselves ensue, a sense of personal insecurity may be decidedly affirmed to be the mainspring of their existence, the point upon which they hinge, and by which, in their continuance and amount, they are entirely and involuntarily determined. Now as there are but two casualties by which the personal safety of the individual so circumstanced can be compromised, namely, the loss of his equilibrium, and the precipitation by his weight of the fulcrum on which he relies, it is clearly to the involuntary dread of one or other of these two events, or the combined agency of them both, that the sensations themselves are to be ascribed, and of the nature of which, in quality and amount, they may be said in a manner to partake. Both these causes of alarm, however, are perfectly distinct, and, like the sensations to which they give rise, capable of acting either separately or in concert, according as the particular circumstances of the case may incline. How completely the exemption from any grounds of alarm on the score of the latter of these (the apprehended instability of the sustaining power) is inadequate to save the individual from experiencing the full force of the impressions in question, while his condition with regard to the former (the insecurity of his equilibrium) is such as to give sufficient cause for their presence, it is unnecessary to demonstrate, both because the position is sufficiently evident without it, and also because the argument to which it tends is not needed in the illustration of the present question.

That the security of the individual, in respect of the retention of his equilibrium, is no bar to the prevalence of the sensations in their fullest force, whenever the situation in other respects is qualified to call them into action, is, however, more to our present purpose, and though perhaps not so generally admitted, not the less true; as may be proved by any one standing upon the brink of some parapeted eminence, the whispering-gallery of St. Paul's, or any other situation alike precipitous and yet protected from the danger of falling over; or when, extended at full length, he endeavours to peer over the edge of some steep declivity; all positions from which the possibility of losing the equilibrium is removed, and the apprehensions of insecurity completely transferred from the individual himself to the fulcrum upon which he rests. From the consideration of these facts, taken in conjunction with the numerous examples we have already detailed, wherein even the ordinary defences of the art have been with perfect impunity dispensed with, we ascertain one important point in the train of our investigation, viz., that it is not to the peculiar construction of his vehicle, and the protection it is calculated to afford against the dangers of falling out, that is in any way to be ascribed the remarkable freedom of the aeronaut from the rigour of those impressions to which his situation in other respects one would be disposed to imagine above all others especially liable. Indeed, the share which his advantages in that particular can have in determining the singular tranquillity of his mind could never be of any very great importance; inasmuch as, after all, the danger arising from this quarter is but of a minor note, compared with that occasioned by the insecurity of the sustaining power. The one is to a certain extent dependent upon the individual himself, and *may* be overcome by strong exertion, long habit, and particular constitution; the other is a casualty entirely beyond his control, against which no exertion of his own is available to protect, and to which no habitation, however extensive, can in the least reconcile or inure him.

Were there grounds for apprehension, therefore, in any way imputable to the condition of his sustaining

power, it is clear that the circumstance of his situation in other respects would never have been available to their suppression; a satisfactory evidence, therefore, that none such at all exist. To what, then, are we to ascribe the singular exception to the usual rule, in favour of the power by which the aeronaut is upheld? or in what manner does the want of connexion, which is its only peculiarity, contribute to the establishment of that immunity which it pre-eminently confers above all other situations to which any shadow of danger is at all attributable? Simply by the manner in which it removes from the mind all the ordinary causes of alarm, and disposes it to admit without hesitation the assumption of its complete security.

As long as the circumstances upon which the fate of an individual depends, are such as to awaken in his mind a doubt of their competency, a tranquil sufferance of his condition is entirely out of the question. The influence of uncertainty, at all times in cases of personal alarm, more painfully insupportable than the actual presence of the thing apprehended itself, is nowhere more strongly manifested than in situations of the nature of those at present under consideration. The bare suspicion, that the fulcrum upon which he relies is about to break away and fall from under him, when once raised in his mind, is an idea so replete with horror that nothing short of absolute conviction, acquired through the evidence of his own senses, is capable of producing confidence sufficient to enable him to bear his situation with anything like equanimity or satisfaction. It is of no avail to the pacification of his fears that any one should remind him that the brow of the eminence upon which he stands in fear and trembling has borne the brunt of ages and the weight of hundreds, or that the lofty column from behind whose guarded battlement he can scarcely persuade himself to look forth is really secure, and that its perpendicularity, from which it appears to him to be in the very act of inclining, is a condition much too stable to be cancelled by the weight of a single individual; so long as his senses continue to indicate a *possibility* of the occurrence of what he dreads, the assurance, nay, the knowledge of its *improbability* is quite insufficient to neutralise their evidence and overpower their suggestions. Indeed, the process of reasoning is an undertaking far too elaborate for the occasion, even were the individual disposed to encourage it. In situations of such impending physical peril, the mind has neither time nor calmness sufficient to enter into a calculation of chances, or to balance the arguments in favour of destruction and those against it, with a view to being guided by the result. The consequences of the conclusion are much too important, and if unfavourable, far too terrible, to be weighed for an instant; and the mind at once rejects with horror any attempt to reconcile it to a situation which allows of the chance of an issue fraught with such irreparable mischief, and teeming with distress even in the very thought. From all these painful impressions nothing but a conviction of his security can ever entirely relieve him; a conviction obtainable only through the exercise of his powers of sight. Any tendency towards *concealment* on the part of the power by which he is sustained, operates to an enhancement of his anxiety, not only from the natural impulse of the mind, which we have before noticed, to magnify the terrors of the "unseen," but also from a consideration of the fact that any difficulty in the way of the inspection is itself a proof that the construction of the fulcrum is of a nature to realise his worst expectations. The approximation to overhang the base, the ruggedness or irregularity of the declivity, circumstances on which its stability is principally dependent, are conditions in fact not only cognizable to the sight alone, but indicative by the facility with which they are submitted to its notice, of the actual state of the support itself in those particulars.

The exclusion from his view may, in fact, be taken as the measure of the insecurity of the individual and the arbiter of his fears. In proportion as the fulcrum approaches a state in which actual peril must be incurred in the investigation, the mind becomes afflicted with the sentiments of its danger; as soon as it has reached a point in which the precipitousness of its inclination has totally excluded it from the sight of the individual standing above, the stability of his position ceases to be altogether dependent upon its form, and becomes a question of consistency in the material of which it is constructed. With such a condition annexed, the fears of the individual assume a darker shade, and, under the double influence of real and apprehended danger, amount to a paroxysm of agony which nothing but the certainty that the connexion in question has no share in his support can either obliterate or appease. To that certainty the absolute knowledge that no such connexion exists is alone sufficient. It is not enough that the continuity of the fulcrum be abstracted from his view; it must cease altogether to exist, and the mind must be aware of it, through the intervention of the senses. In short, it is not the *want of a visible connexion*, but the *visible want of a connexion* upon which the tranquillity of the mind is entirely dependent; a condition in which the aeronaut in his car is alone enabled to participate. Relying

entirely upon another quarter, he neither sees nor looks for a support, the insecurity of which he has reason to apprehend. The power by which he has been raised is all that he has to look to, and *that* unhesitatingly the mind admits to be all-sufficient for the purpose. Were but a pillar to connect him with the earth, or a rope to hang down, of sufficient magnitude to destroy these impressions by substituting a suspicion that *they* were the real means by which the equilibrium of the machine was maintained, giddiness and all the train of attendant symptoms would, I have no doubt, be the immediate consequence.

As the aeronaut increases his distance from the earth, new circumstances arise to give birth to new relations, and call forth new sentiments of admiration and enjoyment. From regarding the altered aspect of the regions he has just quitted, his attention becomes forcibly directed to the condition and peculiarities of that into which he is now, for the first time, perhaps, about to intrude himself. The clouds which he before beheld towering above his head, now begin to gather around and beneath him, and, mingling with the various features of the scene, serve to diversify and adorn a prospect, whose chief characteristics are otherwise but sublime vacuity and unfurnished greatness.

With respect to the intervention of these bodies, however, the particular epochs at which they make their appearance, and the influence which they are capable of exerting upon the surrounding world, it is impossible to affirm anything with certainty. The circumstances upon which they depend, and by which they are entirely modified, the influence of the weather, the condition of the atmosphere, the times and seasons of the year, the nature of the country, the very hours of the day, are matters too indeterminate to allow us to involve them in any general illustration of the career of the aerial voyager. Occasionally, for instance, clouds lie so low that, ere the balloon can be distinctly ascertained to have entirely quitted the earth, she has been received within their limits, and become entirely enveloped in their watery folds. Sometimes, on the other hand, these objects are disposed at such a height, that the balloon either never comes into contact with them at all, or if perchance she should have penetrated through one layer, continues to behold another, occupying a still remoter region of the skies above. At times again, these variable bodies are merely partial, affecting but a small portion of the aerial prospect, and arranged in different masses at different levels, or different stations upon the same level—a disposition I conceive the most favourable to the views of the aeronaut, as affording the best opportunity for that mingled display of earth and heaven which constitutes the chiefest source of his enjoyment; while, lastly, it will frequently occur that the whole face of the heavens is so completely overspread with clouds, that from the moment the aeronaut has once infringed upon their limits, until the actual conclusion of his career, earth and everything that partakes of it becomes entirely excluded from his view. Of this nature was an ascent I once experienced, and of which I attempted to give an account in a letter published in the 'Times' newspaper, October 21, 1836. To this letter I beg to refer the reader as containing the best illustration I am able to afford of the inference of these bodies, and of the particular effects and impressions to which they are calculated to give rise.

From the great variety of which they are susceptible, it is therefore pretty clear that very little can, even by the aeronaut himself, be affirmed with any degree of certainty as to the particular effects which the cloud creation is likely to produce upon his voyage, before the actual moment of its execution. One piece of information, however, of rather a curious nature, a previous consideration of the state of the elements, under certain circumstances, enables him to deduce; I mean with regard to the condition of the firmament above, at a time when, owing to its complete investiture with clouds, all view of that portion of the ethereal hemisphere is effectually suspended.

This information is founded upon observation, and is an inference from the state of the weather at the time with respect to the presence or absence of rain; as far as it goes it may be relied upon as perfectly established; to a degree of correctness, indeed, that few meteorological facts are capable of attaining. To reduce it to a general rule, therefore, it may be asserted that, "whenever a fall of rain should happen to be present under circumstances like those detailed above (namely, where the sky is entirely overcast with clouds), there will be invariably found to exist another stratum of the same bodies at a certain elevation above the former;" and on the contrary, "whenever, with the same apparent condition of the sky, rain is altogether or generally absent, the aeronaut, upon traversing the canopy immediately above him, may infallibly calculate upon entering into an upper hemisphere, either perfectly cloudless, or so far destitute of such bodies as not much to interfere with the general character here bestowed upon it." This observation, which, independent of its value in other respects, is an addition to the stock of the meteorologist which he could never have obtained without the co-operation of the aeronaut, may be

relied upon; it has been confirmed by the experience of Mr. Green, throughout a course of nearly two hundred and fifty ascents, and corroborated by that of various other aeronauts, both at home and abroad, with whom I have conversed upon the subject.* If the invariable coexistence of two circumstances can at all be received as a proof of their relationship together, as cause and effect, the share which the temperature has in determining the condition of the clouds with respect to the discharge of their aqueous contents may be unequivocally inferred, and the above phenomena, upon such grounds, easily explained.

To return from this digression: Varied as are the positions of the clouds, and the forms under which they present themselves, the station which they occupy in the realms of space is confined enough, and, comparatively speaking, but little removed above the immediate surface of the earth itself. As a general rule, the natural region of the clouds may be stated to be a stratum of the atmosphere, lying between the level of the first thousand feet and that of one removed about ten thousand feet above it. Not but that occasionally clouds may be found that trespass very considerably on both sides of the bounds here assigned to them; sometimes penetrating in wreaths of mist to the depths of the lowest valleys, while, on the other hand, long after the aeronaut has passed the upper level of these fancied limits, some faint indications of their existence may still be seen, partially obscuring the dark blue vault above him; such excesses, however, are by no means frequent, and may, in fact, rather be considered in the light of exceptions to a rule than as evidences tending to impugn its general correctness.

It is certainly not to any inability in the medium itself to support them at higher elevations that is to be attributed this restriction of the presence of the cloud creation to the inferior regions of the sky; for where the aeronaut, with all his solid machinery and ponderous appurtenances, can penetrate and abide, assuredly there must be ample means of support for bodies which, by their unlimited powers of extension, can assume almost any degree of specific gravity, and, as it were, adapt themselves at command to media of almost every imaginable degree of tenuity. Rather to circumstances connected with their original formation,—the distance from the source from which they are drawn, the want of that degree of temperature necessary to determine their existence as vapour, perhaps also certain electrical conditions in the atmosphere affecting their dispositions to unite in the form of rain; to these and other circumstances, unfavourable to their generation rather than to their support, should perhaps be ascribed the confinement of clouds within such narrow limits, and the absence from the upper regions of the sky of all those volatile bodies which we, in respect of our own more humble stations, are wont to consider as the emblems of ethereal pre-eminence and the types of all that is remote, lofty, and sublime.

The simple circumstance of their comparative elevation, however, is capable of exerting but little influence upon the prospect of the aerial voyager, unless, indeed, he is contented to confine himself to the mere threshold of the element he proposes to survey; his increasing altitude very soon places him in a situation from whence all things appear equally depressed, and from which indeed he could with difficulty ascertain, by the mere aid of his sight, whether the clouds he is observing are really reposing upon the surface of the earth or seated at an elevation of several thousand feet above it.

Should the condition of the sky now prove to be of the nature of that alluded to,—where, for instance, a dense layer of clouds completely intercepts all view of the earth, the aeronaut will probably have an opportunity of observing another phenomenon connected with the disposition of the vapoury strata,—the beautiful manner in which, even when under the influence of rapid motion, they seem to accommodate themselves to all the variations of form in the surface of the adjacent soil, rising with its prominences and sinking with its depressions; displaying, in short, a "counterfeit presentment" of the country over which they lay, and enabling the spectator

* Two most remarkable instances confirmative of the truth of this observation occurred at the close of 1836. On Wednesday, the 12th of October, an ascent of the large balloon took place from the Vauxhall Gardens, under the circumstances comprised in the former illustration. The sky was completely overspread with clouds, and torrents of rain fell incessantly during the whole of the day. Upon quitting the earth the balloon was almost immediately enveloped in the clouds, through which it continued to work its way upwards for a few seconds. Upon emerging at the other side of this dense canopy, a vacant space of some thousand feet in breadth intervened, above which lay another stratum of a similar form, and observing a similar character. As the rain, however, still continued to pour from this second layer of clouds, to preserve the correctness of the observation, a third layer should by right have existed at a still further elevation; which accordingly proved to be the case. On the subsequent occasion of the ascent of the same balloon, the following Monday (October the 17th), an exactly similar condition of the atmosphere, with respect to clouds, prevailed, unaccompanied, however, with the slightest appearance of rain. No sooner had the balloon passed the layer of clouds immediately above the surface of the earth, than, as was anticipated, not a single cloud was to be found in the firmament beyond; an unbroken expanse of clear blue sky everywhere embracing the frothy plain that completely intercepted all view of the world beneath. The close occurrence of these two cases, and the very striking exposition they afforded, were, in fact, the circumstances which first drew my attention towards the phenomena in question, and led to the adoption of the inference of a mutual dependence between them.

to form, as it were, a sort of phrenological estimate of the character and disposition of the material world within. Indeed, I have heard Mr. Green declare that, with the bird's-eye knowledge of the country his long experience has conferred upon him, he has frequently been able to determine beforehand the district into which he was about to descend, at times when, from the general concealment of the landscape, such information must have been otherwise altogether unattainable.

The most favourable arrangement, however, for the views of the aeronaut who feels an interest and a gratification in the study of the picturesque, is decidedly that in which the clouds, from their broken and disconnected nature, spread at unequal intervals throughout the empty space of air, admit occasional glimpses of the earth in different directions, and passing gradually over its surface, in succession reveal an ever-varying prospect, to the constitution of which heaven and earth so equally contribute that it is difficult to determine to which to award the palm. Such scenes, however, are not for the pen, scarcely even for the pencil: for who by signs can hope to justify a prospect which is much less dependent for its effect upon the materials of which it is composed than the manner in which they are examined—upon its own attractions than sentiments pre-existing in the mind of the person by whom they are enjoyed?

But see! the balloon has already passed the limits we have assigned to these "hoary riders of the blast," and is now rapidly pursuing her course into realms hitherto unknown to man, even on the summits of the highest mountains accessible to his exertions. Here then let us pause for a moment to take a hasty glance at the nature and condition of the scene around, and the sentiments and impressions it is naturally calculated to produce upon the mind of the aerial beholder.

With less numerous subjects for the exercise of his senses, it must not be supposed that these, the remoter districts of the ethereal domain, are by any means deficient in grounds for enjoyment even of the very highest order. It is true here are none of the usual combinations of form and colour which give such zest and variety to the terrestrial landscape; none of those delightful sounds which, pervading the whole habitable world, maintain the idea of animation even in the veriest desert; none of those fragrant exhalations by which—as it were, the music of the vegetable world—every tree and flower gives vent to its own particular sentiments. These, it is true, there are none of; but even in their very absence, the aeronaut finds a source of gratification, more intense, at any rate, if not more interesting, than any with which their presence could have supplied him. Undisturbed by the interference of ordinary impressions, his mind more readily admits the influence of those sublime ideas of extension and space which, in virtue of his exalted station, he is supremely and solely calculated to enjoy. Looking out from his lofty car in every direction save one, and *that*, one from which similar sentiments never before proceeded, a boundless blank encounters his gaze, unbroken, except, perhaps, by bodies whose thin aerial forms and fleeting aspect constitute them sole fitting occupants of such domains. Above and all around him extends a firmament dyed in purple of the intensest hue, and, from the apparent regularity of the horizontal plane on which it rests, bearing the resemblance of a large inverted bowl of dark blue porcelain, standing upon a rich mosaic floor or tesselated pavement. In the zenith of this mighty hemisphere, floating in solitary magnificence—unconnected with the material world by any visible tie—alone—and to all appearance motionless—hangs the buoyant mass by which he is upheld. The world he has quitted, and that towards which he tends, seems to his fancy almost equally remote; and, as he endeavours to scan the empty vault that divides him from the earth, he involuntarily imbibes a sentiment of immense vacuity, which no other situation and no other scene is capable of communicating. It is not that the interval through which his eye has to travel in reaching the ultimate scope of its views is really so vast; for what, after all, are the few thousands that constitute the utmost elevation of the aeronaut, compared with the countless myriads that separate him from the nearest visible object of the external universe, and which, stretching for ever above his head, lie ready at all times to meet his eye whenever he pleases to direct it thither?

It is not, therefore, in the mere amount of intervening space itself that consists the peculiar force of his impressions, but that, bounded to a certain extent by known and recognised limits, in the effects produced upon them by distance, he has a measure for its magnitude to which the mind is enabled to refer. From such a resource he is entirely precluded who seeks to fathom with his eye the boundless abyss of infinite extension; no appreciable object there appears to intercept his view, or regulate his judgment; he sees nothing, and seeing nothing can assuredly form no definite conception of how much it is capable of including. In short, to form an estimate of space from observations directed towards the realms of infinity, requires an *active* exertion of the intellect of which all people, perhaps, are not susceptible; whereas to the individual who studies it thus, as it were, measured off

from the mass, the impression suggests *itself;* the mind is *passive;* the idea is presented to it, and will not be refused. As to the comparative amounts, they signify but little to the general effect; beyond a certain quantity the mind is incapable of containing, even if the eye were capable of conveying an idea of extension. To the human judgment thus restricted, the quantity which divides the earth from the aeronaut at his greatest elevation, inasmuch as it is comprehensible, is far more effective than the utmost extent of infinity to which his eye could penetrate, without the aid of such expedients. Not from the reasons here detailed alone; but likewise because, taken in an unwonted direction, and one where its occurrence is generally coupled with notions of insecurity and fear, both novelty and awe combine to give a zest to the sentiment, from which the extension of his view into another quarter is entirely exempted.

A striking illustration of the influence of matter, in determining the mind to admit the full force of these impressions, is afforded in the contemplation of a solid body in the act of falling from the car, while at a superior elevation, and tracing with the eye its progress as it descends towards the earth;—the silent magnificence of the abyss into which it plunges, the complete isolation of the beholder, the apparent infirmity of the fragile vehicle over the side of which he peers with impunity; then the sudden force with which the body appears to escape from his hand, as if violently launched from a machine, and the equally sudden retardation which, after it has dropped a few feet, it seems to have experienced, together with the length of time it afterwards remains in sight, and the comparative slowness of the changes that increasing distance operates in its dimensions—all natural consequences of the event under the peculiar circumstances of the case, which no less by the sympathies they involve, than by the indications they afford, awaken a mingled sentiment of sublimity and space nowhere else, and by no other means, to the like extent acquirable.

Of these phenomena by which the fall of a body from the balloon is attended, only two require comment; the apparent retardation of its progress, following upon so rapid a commencement; and the length of time which, in despite of the onward course of the balloon, it continues to be discernible in the same direction. The former of these is an impression analogous to that by which the ascent of the balloon itself, *in limine*, is accompanied, and of which an explanation has already been given. It is unnecessary to do more here than to remind the reader that the effect upon the eye is precisely the same, whether the spectator be himself removed from the vicinity of the object, as in the former instance, or the object be removed from the eye of the spectator, as in that at present under consideration; the impression of unusual rapidity, displayed in the first fall of the body from the car, being, no doubt, frequently enhanced by the occurrence, at the same time, of a similar motion in a contrary direction on the part of the balloon from which it is dismissed. The other phenomenon referred to—namely, the long-continued presence of the falling body in the same direction, notwithstanding the onward progress of the balloon—is founded upon such very simple rules that, to the scientific reader, no explanation is requisite. For the advantage of others, however, it may be as well to observe that, by the immutable laws of matter, motion once communicated to an inanimate body must ever continue to influence its progress in the original direction conferred upon it, until it has encountered some other substance to which to impart it. Impressed, therefore, with the motion of the balloon at the time, everything that quits the car without a special impulse in another direction, must continue perpendicularly beneath it until it reach the earth, or, mayhap, encounter in its descent some current of air proceeding from a different quarter, in the resistance occasioned by which, its original motion becomes gradually dissipated and destroyed.

In the midst of this immense vacuity, which, with feeble pen, we have vainly endeavoured to depict, it is not to be wondered should a sense of solitude, to a degree never before experienced, form the predominating character of the feelings with which the aeronaut is, as it were, forcibly impelled to regard the scene around him. Utterly abstracted from all contact and communion with the habitable world, environed and upheld by an invisible medium, without a single object to interrupt the drear monotony of all about him, nothing can be more perfect than the state of isolation in which he is placed; and, as he looks out from his airy domicile upon the immense void that everywhere surrounds him, and regards the exiguous spot he occupies in its vast enclosure, he is driven to acknowledge the force of new impressions, and for the first time in his life *is* really, and *feels* alone. To the production of these sensations, no other situation is at all competent. Likest to it, though still far removed from the complete enjoyment of its conditions, is that of a boat at sea; but *boats* never are at sea, in the full sense of the word; and ships, besides the scene of animation which they invariably and inevitably display, have far too much of man to permit the existence of a feeling which diminishes, in fact, only in proportion as it is participated.

But the most powerful auxiliary to the sense of solitude peculiar to the situation of the aeronaut, is the extraordinary silence that qualifies the region of his new adventure. No words can, in truth, sufficiently represent the remarkable condition of the skies with regard to the absence of sound, or convey any just notion of the extent to which that particular condition is capable of affecting the human organs. Indeed, to describe a state of things depending upon the *negation* of a cause in such a manner as to produce the idea of a *positive* effect, is at no time an easy task; when, however, to the ordinary difficulties arising from the defects of language, is added the want of a proper community of sentiment between the parties, little can be expected to be comprehended by a mere perusal of phenomena however accurately detailed, and however correctly accounted for. All, in fact, that can be said upon the subject by way of illustration is, that here, and here only, absolute silence can be said to have any existence at all. In every other situation in life, on the summit of the highest mountain, in the depth of the lowest cavern, in the desert and on the sea, in the dead of night, and the stern repose of the veriest calm, sound, to a certain extent (however it may escape our habituated faculties), always exists. The vicinity of solid bodies, the resistance of the air, the influence of the changes of temperature upon adjacent matter,—nay, the very process of vegetation itself, are so many sources of sound from which man is never entirely free until the aerial car has snatched him from their influence, and transported him to regions where none such are ever to be found.

Yet is not the unwonted absence of the actual causes of sound the only peculiarity under which the faculty of hearing is exercised in the upper regions of the atmosphere; for, perhaps, at no time is the attention of the aeronaut so forcibly impressed with the singularity of his situation in that respect, as when the natural tranquillity of the surrounding medium is under the temporary influence of disturbance from artificial causes. The contiguity of solid matter has, in fact, another task to perform than the mere generation of sound, in the modifications to which it is incessantly subjecting it, during every stage of its continuance. Scarcely has a sound been promulgated in ordinary situations than it is immediately encountered by a thousand obstacles that alter, impede, protract, derange, and qualify its vibrations, and, by the manner in which they interfere with their simplicity, produce the same effect upon their impressions as the intervention of the obscurating medium, already described, upon the objects of the sight; confusing their outlines, and depriving them of that sharpness of contour and vividness of character which, in fact, may be said to be their natural, or at least their legitimate condition. It is true that of such modifications in ordinary circumstances the ear takes no note. Unconscious of the effects of sound in its pure and simple state, it suffers no particular impression from the presence of a condition to which it is habituated, and from which it has never at any time been absolutely free; nor is it until it has been transferred to a situation where these modifications no longer exist, that it becomes aware of their influence, and able to appreciate their absence. Such is the advantage which it enjoys in the balloon, and such the restrictions under which the sense of hearing is exercised in the upper regions of the atmosphere. There—situated apart from all contact or intercourse with the solid world—no sound ever reaches the ear more than once, or continues beyond the natural duration of its own primary vibrations. Deprived in a measure of all those artificial asperities by which it is usually distinguished, its character becomes totally altered, and, like the landscape to which we have before figuratively referred, it strikes upon the senses in all its native purity, sharply, simply, strongly, and perspicuously delineated. With such qualifications the casual occurrence of sound is consequently attended with even more uncommon effects than the natural stillness of the surrounding medium, extraordinary as that may be.

The various interruptions it occasionally receives from below,—the barking of dogs, the lowing of cattle, the tinkling of the sheep-bell, the exercise of the different instruments of the artificer, the saw, the hammer, and the flail, when at a moderate elevation; the shot of the sportsman, the reiterated percussion of the fulling and other mills, the discharge of artillery, and the voices of those beside him, at a greater distance from the earth,—are all sources of interest to the aeronaut, which please no less by the associations they awaken, than by the peculiar effects with which they are made apparent. Of all the sounds, however, which meet the ear of the adventurer in these exalted regions, none appears to me to bear with it so impressive a character, or to be productive of such awful sensations, as that occasioned by the snapping of the valve in the upper part of the balloon, when in the act of closing after some occasional discharge of gas in the course of the excursion. The sudden sharpness which it displays, in common with the rest, the unusual direction from which it issues—a direction from whence no sound is naturally expected to proceed, the intimate connexion between it, the office it has to perform, and the fate of the aeronaut by whom it is worked, together with the drum-like intonation which instantly supervenes, caused by the extreme tension of the silken dome, in the cupola of which it is situated, and which in a manner serves, like a sounding-board, to sustain and prolong its fleeting impulses,—all combine

to bestow upon it an effect and a sentiment which belong to no other sound, and are experienced in no other situation.

To the enhancement of all these effects, as well, indeed, as of those perceivable in the exercise of all the other senses at immense elevations, the rarefaction of the air, and the temperature of the region, no doubt likewise essentially contribute: not by increasing the ability of the medium for the conveyance of the impression (for in respect of sound, and, perhaps, of all but sight, such conditions are rather detrimental to its qualification for such a purpose), but, by their action upon the organs themselves, producing, as it were, a slightly morbid state, which renders them more susceptible of the impression; as we occasionally perceive to be the case in some diseases, where the irritability of the nervous system attached to some particular organ becomes so much increased, that circumstances which otherwise would have passed unnoticed, produce not only powerful, but sometimes even painful, excitations of the sense to which they are directed. In the exercise of the faculties of hearing, seeing, and smelling, these advantages are most strongly and strikingly experienced, especially the latter, owing as well to the assistance which the rarefaction of the air gives to the dispersion of the volatile particles of the odoriferous essence, as to the morbid adaptation it confers upon the organ to receive them.

With the increase of his elevation, of course, keep pace all those phenomena which depend for their effect upon the diminished density of the surrounding atmosphere; and, as the aeronaut draws nigh to the highest point ascribed to the ordinary course of such adventures, they begin to exhibit, in the altered characters they have assumed, proofs of the unwonted circumstances under which they are experienced. In nothing is this more strongly exemplified than in the appearance of the firmament itself. The colour of the sky, the increasing darkness of which we have already noticed, has now reached a pitch of intensity so great as scarcely to seem compatible with the ethereal consistency of a mere gaseous accumulation, and almost to warrant the impression of an approach to something whose limits are more substantial and defined. M. Gay Lussac, in his second ascent from Paris, in which he attained an excessive elevation,* represents the colour of the sky, especially about the zenith, as observed from the highest point in his excursion, to be on a par with the deepest shade of Prussian blue; an observation the justness of which will be felt and acknowledged by all who have ever proceeded to any distance from the surface of the earth.

In order more properly to comprehend the grounds upon which these alterations are chargeable, it is absolutely necessary that some insight should be obtained into the nature of the appearance of the firmament in general, of which the phenomena in question are merely modifications.

That the aspect which the heavens present whenever circumstances permit us to enjoy an unobstructed view of them, whether it be the azure complexion of the glowing day, the sable livery of night, or the milder shades of twilight grey, by which the transitions from the one to the other are invariably distinguished, is not a condition to that effect in any way inherent in the body of the atmosphere itself, a variety of arguments satisfactorily enable us to determine. The most striking of these are deduced from the following observations:—First, that whenever any portion of it happens to be separated from the general mass above it by the intervention of clouds, no symptoms of the prevailing tints can ever be detected in the part so intercepted, although by reason of its superior density it may, in respect of actual quantity, equal, if not exceed, all the rest of the medium which lies beyond it; and secondly, that instead of appearing lighter the less the quantity through which the eye has to penetrate (as in the case of all other known transparent bodies, which possess a colour of their own), its shade continually increases in intensity the more the superincumbent mass is diminished by the translation of the spectator to a higher position within it.

That the existing appearance is not, as some have vainly imagined, a general contribution raised by reflection from the surface of the earth, and modified according to the particular predominance of the solar influence, is

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* The greatest altitude to which any balloon has ever been *known* to ascend [with the exception of Messrs. Coxwell and Glaisher's ascents] is that accomplished by M. Gay Lussac in this voyage, and is calculated at seven thousand and sixteen French metres, or twenty-two thousand nine hundred and seventy-seven *feet* four inches above the level of the sea (see p. 117).

I am aware that other aeronauts lay claim to higher honours; M. Blanchard, for instance, states himself upon one occasion to have attained an elevation of nearly thirty-two thousand feet—an assertion upon which MM. Margat, Garnerin, Robertson, and others, his successors in the trade of aerostation, have from time to time considerably improved. For these pretensions, however, there is not the slightest foundation; nor would it be a matter of much difficulty to demonstrate that the balloons they employed (with the dimensions of which we are well acquainted) could not, even if inflated with the purest hydrogen, have supported their simple weights at much above one-half the elevation they would fain have persuaded us they attained.

likewise a conclusion which with equal clearness we collect, partly from a consideration of the fact before observed, that when the communication happens to be dissolved by the interposition of clouds, the character in question, whatever it may happen to be at the time, entirely disappears in the portions contiguous to the earth, while neither in quality nor intensity is the slightest alteration perceptible in those which lie beyond; and, partly from the observation that in all countries, under every variation of climate, and through every change of season, the genuine aspect of the sky is virtually the same.

Since, then, the appearance of the heavenly arch is neither a quality which resides in the substance of the atmospheric volume (the only material obstacle of whose presence in that direction we are aware), nor is obtained by the process of reflexion from anything which exists on this side of the space which it subtends, it is evident that no other way remains by which it can be accounted for than by a reference to the condition and modification of something which occupies or proceeds from the interval which lies beyond. To enable us to justify our conclusions upon this score, we must first endeavour to ascertain what is the natural aspect of boundless space, or what would be the appearance of the mighty vault of heaven could we but direct our gaze into its vast enclosure, unencumbered by the presence of a medium of refraction. The inquiry is fraught with awe, no less than interest.

It almost seems like intruding upon the especial domains of the Almighty to attempt to tear the veil from the charms of boundless space, and expose the secrets of a condition of which our visual faculties but render to our senses an account as mysterious and imperfect as that which our mental ones with their utmost exertions are able to convey to our understandings. To say that the heavens, or that portion of space beyond the limits of our atmosphere, which we are wont to honour by such a name, possess a colour, would be, in truth, to employ a misnomer. Space—infinite space—unfilled with matter, must really be devoid of colour; and, excepting in the bodies it contains, must ever present to the eye of him who views it in all its natural majesty, the terrific aspect of a black unfathomable abyss. To confer the idea of a colour, or permit the rays of light in any way to vary its appearance, the presence of a transparent medium is absolutely requisite. Near the body of the earth, and of most of those other objects with which astronomy has made us acquainted, such a medium obtains in the atmosphere by which they are surrounded; and in the effects of this atmosphere upon the aspect of the black vault behind, lies the only condition that exists to vary the visual presentment of void and infinite space. By the combined exertion of two of its properties this result is accomplished; first, by the diffusion of the white rays of light, whereby the extreme obscurity of the background is tempered into paleness,* and in the next place by the occasional interposition of a new colour obtained from the rays of light transmitted through it from above, whereby the original in its subdued intensity becomes at times invested with a colour compounded of them both.

To the full force of the former influence much is, no doubt, contributed by the presence and disposition of solid matter in the neighbourhood of the field of view, by means of which the adjacent portions of the surrounding medium become, as it were, charged with the superfluous rays of light from various quarters, tending not only to distract the eye of the spectator, and to confuse his prospect, but also to reduce, by the copious admixture of white light, the natural intensity of whatever object may happen to be exposed to it. To what an extent the diffusion of light so supported is competent to produce the results ascribed to it, we see clearly evinced in the extraordinary effects occasioned by the temporary suspension of its influence. No sooner has any interruption taken place, either through the discontinuance of the supply, its artificial exclusion from the field of view, or a diminution in the capacity of the medium for its conveyance, than the eye immediately reads the change in the unwonted darkness of the sky, and (when promoted to a sufficient extent) in the renewed appearance of the luminous bodies which it infolds. Of this illustrations are naturally afforded in the approach and presence of night—during the continuance of a solar eclipse, when the obscuration has reached a sufficient magnitude,—or still more remarkably upon the occasion of any unwonted rarefaction in the atmosphere, such as is frequently found to precede a sudden

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* The influence of atmospheric irradiation upon the aspect of the void space by which it is backed was first suggested by the father of the pictorial art, the celebrated Leonardo da Vinci, and afterwards revived and adopted by M. de la Hire, as a probable cause of the azure colour of the sky. In support of this theory a variety of experiments were adduced to prove that black, when beheld through a white or colourless medium, always inclines to assume a blue or azure tint. The truth of these deductions, however, is more than doubtful. The proper product of black and white, or, in other words, of *no* colour with a combination of *all* colours in the proportion in which they exist in solar light, is always grey: nor do I believe that any other colour could ever result from their admixture, no matter the proportions or the means whereby it might be sought to unite them. To what to attribute the fallacy of their conclusions I really know not, unless indeed it might be owing to an incorrect estimate of the colours of the substances employed in their experiments, or the want of proper precautions to avoid the introduction of colours obtained by refraction from the transparent media through which they were examined.

change from fine to foul weather; and artificially, and with equal effect, by removing to a distance from the surface of the earth in a balloon, or by proceeding in the other direction to the bottom of a well or vertical shaft, sufficiently deep to afford a complete protection against the influence of the circumambient irradiation.

But the mere diffusion of light, to whatever extent it might be carried, although it might alleviate the intenseness of colour in any object, could never avail to give it a new one, or make that assume "the front of azure blue," whose legitimate aspect was unmitigated sable. This is a result which requires the intervention of another property in the medium; such a one, for instance, as that alluded to, whereby the rays of light transmitted through it from above, are made to affect a colour suitable to the compound required.* As the intensity of this colour, as well as that of the black vault by which it is supported, is a quality subordinate to the influence of atmospheric illumination, whatever tends to the abatement of that illumination, either by the curtailment of the supply, its artificial exclusion from the field of view, the diminution of the capacity of the medium for its conveyance, or the remotion from a neighbourhood where its natural amount is increased by adventitious reflexion, tends likewise to increase the intensity of the sky, and bring out more forcibly the natural obscurity of the ethereal scene. Of these latter, the ascent in the balloon is a striking illustration. Diminishing at once the density of the medium, and the amount of its terrestrial irradiation, at every step he recedes from the surface of the earth, the aeronaut obtains in the darkened aspect of the heavenly arch unerring tokens of his approach to the nether limits of the void and infinite gulf that lies beyond him; and, I have doubt, could he but continue his course until he had attained the outward margin of the atmosphere, he would, upon directing his view into the realms of vacuity, behold an impenetrable abyss of perfect blackness, in which every visible source of light would stand like a disk of solid flame, unaffected by the vicissitudes that, for one-half the period of their revolutions, exclude them from the eye of the terrestrial spectator.

How long before that extreme was attained, the latter part of this description would have been realised, and the heavenly bodies revealed to the naked eye in broad daylight, I cannot take upon me to determine; if, however, the obscuration of the sky (upon which the occurrence of the phenomenon in question entirely depends), were to continue to increase at the same rate we observe it in the earliest stages of the ascent (and there is every reason to admit the conclusion), I do not think that the possibility of witnessing such an occurrence is entirely beyond the hopes of the aeronaut adventurous enough to attempt it, and provided with means corre-

* With the existence of such a property we were first made acquainted by the researches of Sir Isaac Newton; who, having ascertained that vapours, when about to condense and coalesce into drops, first become of such a size as to elicit the blue rays of transmitted light, was induced to attribute the azure colour of the sky to a condition particularly favourable to the exercise of such a property, which, it was presumed, existed only in the remoter regions of the upper air. The existence of a vapour at all times present in the atmosphere, a circumstance essential to the views of Newton, was, however, a weak point in his theory, which has induced subsequent inquirers to look for some more permanent quality in the same quarter upon which to charge the occurrence of the observed phenomenon. Accordingly, after a variety of experiments, a French philosopher, M. Bouguer, considered that he had solved the difficulty by referring the separation of the rays in question to a difference in the *momenta* of the different constituents of solar light, whereby the red alone, supposed to be possessed of superior motive energy, made their way unobstructed to the surface of the earth, while the blue, considered of weaker impetus, unable to advance, remained behind to imbue with their particular colour the remoter strata of the atmospheric fluid by which they had been absorbed. These views of M. Bouguer, sufficiently ingenious considering the then state of the science, the recent establishment of the theory of undulations requires us to interpret after another form.

Admitting the exclusive progress of certain rays, but rejecting the grounds of different momenta by which it was formerly wont to be explained, reference must now be had to another principle, namely, the *critical angle of incidence*, whereby the blue rays, instead of entering the body of the atmosphere, are reflected at an angle, and would be altogether dismissed unnoticed, but that, owing no doubt to the extreme tenuity of the upper strata of the atmosphere, they have already proceeded to a considerable distance ere they have encountered sufficient consistency to determine their return. For the benefit of the unlearned, however, we may as well observe that it matters nought in the least to the subject in hand which or whether any of the views here proposed be the correct one. It is enough for us that there is a property of the nature referred to existing in the upper strata of the atmosphere; and *that* is a fact of which we have sufficient proof in the evidence of our senses.

Indeed, but that the limits of a note are too restricted for the purpose, it would not be a difficult matter to point out occurrences which do not appear to consist with any of the views here taken of the subject. For instance, I do not see upon which of these grounds can be explained the phenomenon (very frequently observable upon occasion of the setting sun) of the complete determination of the blue rays to the quarter directly opposite the seat of that luminary, leaving the rest of the heavenly hemisphere comparatively devoid of any such inclination. In all these cases the blue, if really obtained by the decomposition of solar light *in transitu*, must not only have traversed one radius of the atmospheric horizon in company with the red, but afterwards exclusively continued its course to the further extremity of the opposite one. Another circumstance, apparently incompatible with the foregoing views, is the extraordinary blueness discoverable upon the occasion of a sudden rarefaction in the atmosphere: were the blue in these cases merely the complement of the red, previously interrupted in its passage, its subsequent intervention should only have restored the whole to its primitive condition of a colourless compound.

These objections, I beg to observe, are by no means intended to impugn the correctness of the theory of undulations as a system explanatory of the nature and properties of light in general. On the contrary, it is upon the assumption of its superiority that we are led to question the accuracy of any views to which its principles seem in the slightest degree irreconcilable.

sponding to the peculiar exigences of the occasion. Some indeed there are, who, even without these advantages, pretend to have attained situations in the ordinary exercise of the art, from whence the existence of such a phenomenon could clearly be discerned: I should rather, however, suppose that this assertion was merely an exaggeration of the fact, that at their utmost altitude they were able to distinguish the presence of the heavenly bodies sooner than they could have been perceived by persons situated upon the actual surface of the earth; an assertion which in fact amounts to nothing more than what we know would have been experienced under any circumstances of superior elevation, no matter how slight. With every degree of removal from the plane of the terrestrial horizon, the capacity of the surrounding medium for the diffusion of light becomes diminished, and the contrast in favour of the spectator (which is the only cause of their suppression) being weakened, the stars of course make their appearance at an earlier hour than they would if that contrast had to wait the decline of day to effectuate its abatement. The question is evidently, therefore, one of comparison, and is as easily put to the test by ascending to the top of a hill as by encroaching upon the limits of the sky in a balloon. If I mistake not, something of the kind is mentioned by the elder Saussure, in his account of the first ascent of Mont Blanc, as having been observed upon the summit of that mountain; an observation which has been repeated in other parts of the globe by all travellers who have ever succeeded in attaining great elevations upon the surface of the earth. That such a result could be produced by an artificial exclusion of the light, as for instance in the bottom of a deep well, or any other excavation of sufficient profundity, was a fact well known to the ancients, who, in Egypt especially, were in the habit of constructing pits on purpose to aid them in their study of the heavenly bodies; many relics of these subterraneous observatories remaining to the present day to bear testimony to the industry and acquirements of those learned Pagans.

In consequence of the increased removal from the vicinity of the earth, the temperature of the surrounding medium has become considerably reduced, and were it not for the absence of all atmospheric motion would, no doubt, be severely manifested to the feelings of the aeronaut. At what particular period of the ascent, this decrease attains a minimum, or indeed whether such a result exists within the range of aeronautical adventure, I am not able with any degree of certainty to state. The solution of the question, which is undoubtedly an interesting one, depends chiefly upon the point to which the calorific influence of the earth's radiation extends, and is only to be arrived at by a long-continued series of experiments and observations. Of course, the results here, as elsewhere, will be found to vary with the climate, the season of the year, the hour of the day, and the state of the atmosphere at the time prevailing. In one respect particularly, the latter is capable of exercising a very sensible influence over the thermometrical condition of the upper regions; I mean where clouds to any amount intervene, whereby a large extent of reflecting surface becomes presented, and a very considerable portion of the heat of the solar rays returned into the body of the atmosphere which lies above. As this is an arrangement of the sky more frequently to be met with in winter than in summer, it follows singularly enough that the effects of a low temperature are much less likely to prove injurious to the aeronaut in the exercise of his art, during the more rigorous portions of the year, than those which everywhere else come under the denomination of the milder and more serene.

Considering, therefore, the number and irregularity of these disturbing causes, it will appear pretty evident that no exact measure of the temperature, and, consequently, no just representation of its effects upon the human frame could be afforded that would apply with equal correctness to all the circumstances under which it might be tried. In general, however, where there are no clouds to interfere with the natural progress of the sun's rays, a temperature of 32° Fahrenheit may be expected to be encountered at an elevation of about seven or eight thousand feet above the level of the sea—that is to say, in these climates; the region of eternal frost, or as it is geographically termed, the *line of perpetual snow*, entirely depending upon the latitude of the place, and diminishing in elevation in proportion as it increases its distance from the terrestrial equator. Beyond this altitude the temperature, as before, keeps continually decreasing, though with waning rapidity, and at an elevation of twenty-two thousand nine hundred feet, the thermometer, as observed by M. Gay Lussac, had fallen to 9·5° of the Centigrade division, or 17·1° below the freezing point according to Fahrenheit.

Supposing, however, the state of the temperature to have been in any instance even twice as low as that above indicated, still there is much reason to question whether at any time the sufferings of those exposed to it can have been so severe as many would fain incline us to believe. Certain allowances ought, no doubt, to be made for the constitutional peculiarities of different individuals; and much ambiguity must always be expected to

prevail where personal feeling is the subject of discussion, and the sense itself the only test to which it can be subjected. But with all these admissions, there is still sufficient evidence in the experience of those who both naturally and by artifical means in the way of experiments have placed themselves in circumstances of like exposure upon the earth, to authorise a doubt that much inconvenience ever did or could accrue to the aeronaut, who, in the exercise of his vocation, may have penetrated to the utmost limits his means in other respects would allow him.

Having now attained the highest point to which it is our intention at present to proceed, we will pause for an instant to take a cursory glance at the earth, ere we prepare to incline our journey thitherward again. The landscape which, for some time back, has been gradually displaying symptoms of decreasing perspicuousness, has now suffered so much from the effects of distance that it is not without difficulty that any of its ordinary features can be distinguished. Not that any abatement appears to have taken place in that vividness of contour which we have before observed to be the never-failing peculiarity of the terrestrial scene when viewed from the car of the balloon; but that the objects themselves have now become so much reduced in size that many of those, the most familiar and characteristic, have altogether become extinct, and the rest so much estranged in their appearance as to contribute but little to the recognition of the prospect of which they form a part.

Amid this scene of universal disfiguration all perception of comparative altitudes is utterly out of the question. Removed to such a distance from the eye, and solely submitted to a vertical examination, the whole face of nature, in fact, appears to have undergone a process of general equalisation; the houses and the trees, the mountains and the very clouds by which they are capped, have long since been consigned to the one level; all the natural irregularities of its surface completely obliterated, and the character of the *model* entirely superseded by that of the *plan*.

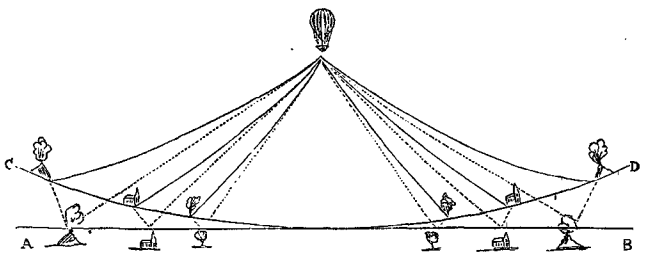
It has frequently been inquired of me, whether under circumstances of such excessive elevation any symptoms of convexity can be detected in the appearance of the horizontal plane, such as a knowledge of the real form of the terrestrial globe might have authorised us to expect. When, however, we consider the immense disproportion which exists between the actual diameter of the earth and the utmost altitude to which man ever did or could attain above its surface, we shall cease to look for such a result, or be surprised at observing the deficiency. Were we to asume an elevation of forty-two thousand feet (which is nearly double what has hitherto been accomplished) as the *ne plus ultra* of aeronautical enterprise, still, computing the earth's radius at four thousand miles, and reckoning five thousand two hundred and eighty feet to each mile, the prominence of the spectator beyond the surface of his horizon would even then amount but to the thousandth part of its extreme lateral extension: in other words, he would have only reached a distance beyond the plane of his vision, as great as the thickness of the smallest letter we are now employing (estimated at the hundreth part of an inch) would project upon the face of a globe of ten inches in diameter. In short, his newly-acquired position would no more enable him to discern the sphericity of the earth than the eye of a beetle would convey to it an idea of the convexity of the mountain whose rounded summit it was slowly labouring to ascend.

In answer to this, the reader may perhaps suggest the well-known phenomenon of a ship at sea approaching from a distance, and adduce the gradual disclosure of its parts as an evidence of the possibility of obtaining, under a favourable conjuncture of circumstances, ocular testimony of the nature which we have here attempted to disprove. The example, however, is by no means a case in point. It is not the *sphericity* of the earth that the eye in such cases observes, but merely its *effects;* and therein can no more be considered as reading the convexity of the earth, than a man looking at his shadow upon the wall can be said to be observing the taper which stands upon the table at his back. Without the convexity in question, it is true the phenomenon observed could not have taken place; but neither, on the other hand, would the convexity in question have been observed had not the said phenomenon been present to disclose it.

But even if the conclusion were otherwise, still the cases are by no means analogous, nor could any argument be drawn from the capacity of the eye in the one instance to sanction the expectation of a similar result in the other. Comparative altitude, which is, in fact, the only test of prominence, is a condition the knowledge of which is only acquirable by means of an examination conducted at right angles to the plane of extancy; or, in other words, by observing the *profile*, more or less, as it appears represented upon the substance or substances which may happen to be aggregated in the rear. From the enjoyment of this advantage the aeronaut, by his position, is thoroughly precluded; all his views are necessarily downward, and all his perceptions of form confined to the observation of surfaces projected upon the plane beneath him.

With all these considerations, however, the inexperienced reader will, no doubt, learn with surprise that the real form of the earth, as beheld from the car of a balloon sufficiently elevated in the air, is absolutely the very reverse of that which a first view of the case may have hastily inclined him to expect. Such, however, is undoubtedly the fact. So far from following the course dictated by the true conformation of the earth, and sinking in proportion as they recede, the edges of the terrestrial plane actually assume a contrary inclination, and, rising as the aeronaut increases his altitude, realise in their progress the appearance of a *vast bowl or basin* extended on all sides around him.

Unexpected as this phenomenon may at first sight appear, it is, nevertheless, but the natural consequence of the laws of refraction acting under the peculiar circumstances of the case. Diverted from the straight course which the sight would at all times pursue, were it unobstructed by a medium of refraction, the lines under which the various objects are beheld become gradually inclined upwards, referring the objects themselves to points in their new positions, at distances from the eye of the spectator equal to those at which they are actually situated. This will be better understood by a reference to the annexed diagram, in which the station occupied by the aeronaut is represented by the small balloon; the direction which the sight would have travelled had there been no refracting medium by the dotted lines; and that which in consequence it is forced to assume by the plain ones. As the *distance* is not falsified by the refraction, the various objects upon the terrestrial horizon A B (as there depicted) will, in appearance, be transferred to stations equally remote from the eye, and be found occupying a curve, C D, formed by a close continuation of points in the refracted lines of vision, equidistant from the eye with those which they represent upon the horizontal surface of the earth.




But it is now time to conclude. Too long already I fear have I detained the young adventurer in the realms of upper air; more especially as this is his first attempt, and he must no doubt feel anxious to return and quell the fears of his family and friends below. We will therefore pull the valve, and commence our descent.

And let not the reader suppose that in this seemingly simple phrase consists all that is required to the achievement of this most important operation; and that the aeronaut has nothing to do, when he desires to terminate his excursion, but to pull the valve, and take his chance for the result. It is in the conduct of this part of the voyage especially that lies the great art of the practical aeronaut, and upon which his own safety and that of his companions ultimately depends. In choosing the critical moment of the descent, and regulating his forces accordingly, much judgment and great skill are necessarily required. A certain spot, frequently at a considerable distance, is to be attained, which experience points out as best suited to the purpose, and a variety of circumstances acting separately and in conjunction must be taken into account to ensure a successful issue in the attempt.

The exact rate and direction of the machine at the time, and the possible variations in both, to which it may be subjected by the currents it may happen to encounter in its progress towards the earth; the amount of retardation it is sure to experience when, in the act of descending, its force of gravitation begins to operate; the quantity of gas necessary to be discharged to produce such a course as will best correspond with and satisfy these combined demands, under the restrictions of speed which a due regard to the safety and feelings of the parties necessarily imposes; all these are considerations which require to be present in the mind at once, and with such a degree of command as will enable the aeronaut in an instant to avail himself of the means within his power to provide against the consequences of any unforeseen event that may arise to derange or confound his previous calculations. The necessary acquirements for the perfect management of the descent are consequently of no ordinary nature, nor are they by any means to be met with in ordinary persons. It is not enough to entitle a man to the appellation of an accomplished aeronaut that he shall have been able to conclude his operations without breaking his neck, dislocating his limbs, or tumbling himself and his companions out of the car; to that extent all persons, with few exceptions, who have ever ascended upon their own responsibility, have shown themselves competent; and, indeed, the actual peril of life or limb is so slight that chance alone is sufficient of itself to justify the presumption of a favourable result upon that score, even in the absence of any interference whatever on the part of the manager,

beyond what is necessary to determine the descent of the balloon. The mere avoidance of danger is, therefore, not the only circumstance that occupies the attention of the skilful aeronaut; a variety of other considerations, of secondary importance, it is true, likewise enter into his designs. The perfect convenience and comfort of the parties, no less than their absolute security, require to be consulted: they must neither be brought to the earth with violence, jerked out of the car, dragged along the ground, hurled against buildings, nor run amongst trees; they must neither be landed in a marsh nor in a quagmire, in the middle of a wood, on the top of a house, nor in the rigging of a ship, as some have had the luck to experience before now, nor decanted into the river, as has also been the fate of more than one adventurous hero whose name figures in the annals of aerostation.

In the next place, the safety of the balloon requires and engages the solicitude of the skilful and prudent aeronaut; nor can any descent be said to have been even respectably conducted in which the slightest injury has been allowed to accrue to that most important and valuable part of the apparatus.* This in itself involves a great many considerations. All places are by no means equally adapted for such purposes. The soil must be of such a nature as will facilitate the attachment of the balloon; it must not be so hard that the grapnel cannot easily penetrate, nor so light that, having entered, it is unable to retain its hold; it must be free from trees or bushes, by which the silk would be sure to be lacerated, and contain a sufficiency of open, clean sward as will favour the emptying and folding of the dismembered machine as soon as its task has been performed.

Last, though not least, some regard must be had for the tenants of the soil itself: much care should, therefore, be taken to avoid attempting to descend in a place where the crops are of such a nature as to suffer from the operation; a practice extremely reprehensible, not only as being the means of inflicting serious injury upon others, but likewise as tending to bring disparagement upon the art, trouble to future aeronauts, and frequently much loss and inconvenience to the parties themselves, from having their balloon seized and retained in compensation for damages, which the possession of a little skill would have enabled them to avoid.

All these are considerations which, though entirely overlooked by ordinary persons, nevertheless always enter into the calculations of the accomplished aeronaut, and require the exercise of no ordinary qualifications. Mere experience is by no means sufficient for their acquirement; for men may ascend for hundreds of times, and still keep bungling on to the end without the slightest advantage or improvement; there must be a power besides to turn it to account; a judgment to interpret its suggestions, and coolness to apply them; penetration to embrace all that is requisite at a view, and quickness in calculating the results; prudence to avoid danger, and courage to confront it: in short, all the qualifications, to a certain extent, by which the skilful general is distinguished in the fields of war; and I should but ill acquit myself of my duty as an honest though humble chronicler of aerostation were I not to mention as pre-eminent above all others in everything which regards the practice of this delightful art, my friend, the veteran aeronaut, Mr. Charles Green. Other men there are, no doubt, in abundance, who, *under favourable circumstances*, can manage well enough to bring their operations to a close without material injury to themselves or their companions; so far I have already said that mere chance will generally favour the attempt: it was reserved for Mr. Green to reduce these operations into a fixed and available system, and convert that chance into a matter of certainty and design.

It is not my intention to pursue the details of the descent with the same precision with which I have treated those of the earlier stages of the art. For the most part they will be found to be merely a counterpart of the preceding, differing only in the order of their occurrence, and would but weary the reader, already sufficiently so, no doubt, without contributing anything further to his stock either of information or entertainment. The few peculiarities it possesses are easily explained. Immediately upon commencing the descent, a painful impression is generally experienced in the ears, more or less acute according to the rate at which that operation happens to

* As a proof of what may be done by the exercise of proper skill, it is worth observing that the balloon which Mr. Green generally employs has already ascended two hundred and fifty-six times—one hundred and seventy with Mr. Green himself; eighty-three in charge of his son; and three times in that of his brother, Mr. Henry Green; notwithstanding which it still remains as serviceable as ever.

The great Vauxhall balloon, the unwieldy proportions of which render its management doubly arduous, has already made fifteen ascents, under the direction of the same accomplished aeronaut, among which some have been executed under circumstances of peculiar difficulty and hazard. Twice have they been deprived of the use of the grapnel by the violence of the wind, and forced to resort to adventitious expedients for the purpose of stopping the balloon—once by the parting of the cable, and once by the actual fracture of the iron itself. It is unnecessary to observe what must have been the force of the wind by which such powerful effects were produced. Both these accidents occurred in places particularly unfavourable to the manœuvres of the aeronaut, being thickly beset with trees, and so circumstanced that had not the progress of the balloon been opportunely arrested, they would have reached the coast, and been blown out to sea. With the greatest difficulty, and by the exercise of consummate skill alone, the balloon was saved from destruction. And yet with all these escapes, and the ordinary casualties of the art to boot, the silk has never so much as received the slightest puncture.

be conducted. I have said *generally*, because much uncertainty exists with regard to the liability to this impression, there being some in whom it is much more strongly developed than in others; while, again, a few there are whose physical constitution seems to exempt them from its influence altogether. The cause of the sensation is simply a renewed pressure upon the orifice of the Eustachian tube, consequent upon the passage from a rarer into a denser medium, and is so far similar to that experienced in a diving-bell, although, as might be expected from the different constitution of the experiment, not nearly so strong in its indications. Indeed, in the latter, instances are not infrequent in which it has been pushed to such an extremity as to be attended with the sensation of a violent explosion in the ear, occasioned, as it is supposed, by the sudden bursting open of the valve by which the orifice of the tube is closed, producing considerable pain, nausea, and temporary (and, in one case that I am acquainted with, even permanent) suspension of the power of hearing. This sensation continues until the descent for the time is concluded, and the equilibrium between the external air and that confined in the cavernous processes of the ear has been completely restored. Why it should not be experienced in the ascent as well as the descent of the balloon is a circumstance most probably depending upon the valvular construction of the parts themselves, the greater facility which is afforded to the egress than the ingress of the atmospheric fluid, and consequently the minor opposition encountered in the establishment of the equilibrium above alluded to.

This, so far as I am aware, is the only physical impression peculiar to the descent; as to the mental ones, I can only say, to speak from my own observation, that regret, intense regret, at being forced to relinquish so delightful a situation, is the only sentiment I have ever found to be an invariable attendant upon the conclusion of the aerial voyage.

But we have now no time even for the indulgence of these melancholy considerations. The balloon is already approaching the earth. The trees, hedges, roads, and other features of the rural landscape, which for some time back have been growing gradually upon the eye, have now resumed their original distinctness, and appear in quick succession, rapidly receding in our rear. Several persons now also can be distinguished, either standing in mute astonishment, looking up at our approach, or hurrying from all directions in the hopes of being present at our descent. At length the field we have been so long aiming at appears directly before us; the grapnel just tops the hedge, and alights immediately within it. For a few seconds it continues to drag along the ground with a succession of shocks, the violence of which the elastic cable serves considerably to abate. One, however, more forcible than the rest at last ensues and fixes the anchor in the soil. Restricted in her progress, the balloon for the first time becomes sensible of her captivity, and seems to concentrate all the strength she possesses to effectuate her liberation. But it is all in vain. The anchor holds; assistance multiplies in every direction; the people run in and seize the rope; the loss of a little more gas tames the gigantic struggler, and she stands at length secured upon the plain.

In the preceding sketch it will be perceived that I have made no account of the effects of diminished pressure upon the physical condition of the aeronaut, which some have depicted in such glowing terms. But the truth is, that were I to speak from my own knowledge, or that of others upon whose authority I might venture to rely, and whose experience on this score is more important than my own, I should be rather inclined to dispute their existence altogether; at least, as obtaining at any elevation to which man, with the means he has hitherto employed, has ever been capable of ascending. In this dearth of actual testimony, all that remains for us to resort to is a circumstantial investigation of the nature of the proceeding itself, and upon these grounds it will be seen that the conclusion to which we have just arrived receives the strongest confirmation.

In the translation to the upper regions of the atmosphere, the human body, as a natural consequence of the diminished density of the medium, becomes subjected to the influence of two specific changes; namely, the remotion of pressure, and the diminished supply of oxygen gas. Now the former of these, *taken abstractedly*, I conceive to be an event of a most innoxious character, and of itself, simply, incapable of producing any effect upon the animal economy whatever. So far, indeed, is this the case, that I question if any result, seriously prejudicial to the organisation of the individual, would accrue were he to be exposed to the action of a perfect vacuum in the receiver of an air-pump, providing the operation were conducted sufficiently slowly to permit the gradual escape of the included gases. This is a fact as easily demonstrated by experiments upon the inanimate as the living, and the results seem to justify our conclusion to the fullest extent. Upon the lungs, certainly, no effect whatever, could be produced; the air contained therein is always at liberty to escape, nor would any consequences ensue from its total abstraction, so far as the simple condition of the parts themselves was concerned.

With regard to the diminished supply of oxygen, however, the case may be different; the material in question has a specific action upon the lungs, and in certain quantities is absolutely requisite to enable them to perform the functions for which they are ordained. When, however, we consider how very small a portion (not more than the five-hundred-and-sixtieth part) of the whole quantity contained is consumed at each respiration,* and moreover, regard the facility wherewith the organs in question adapt themselves to the changes to which, occasionally to a considerable extent, they are exposed in the ordinary course of life, the great latitude which nature has bestowed upon them in the exercise of functions so essential to the support of animation, we shall perceive ample grounds for the belief that no sensible obstruction ever has or could have been afforded to the aeronaut by the impoverishment of the atmospheric medium at any altitude to which he has ever been capable of ascending. These observations are of course only intended to be applied to persons in sound health; it is well known to what an extent the perceptions in this quarter become sharpened by constitutional delicacy or local disease. The circumstances under which the ascent has been effected are likewise capable of exercising much influence upon the physical condition of the individual, and have no doubt frequently led to the adoption of an opinion favourable to the admission of the sensations in question as natural consequences of existence carried on in a highly attenuated atmosphere. To this cause, in fact, I have no doubt are to be attributed the symptoms, slight as they are, which M. Gay Lussac describes himself as having experienced in his second excursion, when he had reached an elevation of twenty-three thousand feet; the greatest [with the exceptions already named] attained by man. The only alterations which at this altitude he was able to detect in the exercise of the functions of life, which could in any way be imputed to the rarefaction of the surrounding medium, was a slight increase (amounting altogether to not more than one-third) in the ordinary action of the heart and lungs: considering what he says concerning the state of his health at the time, suffering from extreme fatigue, deprived of sleep during the whole of the preceding night, afflicted with a violent headache, and labouring, no doubt, as might be very reasonably expected, under much anxiety, not only on account of his own personal safety, but for the result of an expedition in which so much was at stake, and from which so much had been anticipated, the only cause of wonder is that the consequences should have been so slight as they were. Indeed I have little doubt that had it been tried, they would have been found to have been fully as great before he quitted the ground, upon his entering the car of the balloon, as at the excessive elevation whereat he was first induced to observe them.

To those who regard the difficulties experienced in the ascent of high mountains, the painful sensations and distressing symptoms to which all have more or less been subjected in the attempt to gain great elevations upon the surface of the earth, these observations and the conclusion to which they naturally conduce, may, no doubt, appear surprising. But the situations referred to are by no means analogous: in the former, a circumstance requires to be taken into account which forms no part of the phenomena of aerostatic elevation; I allude to the excessive muscular action necessarily developed in the attempt; giving rise to an inordinately increased circulation, and creating an equally increased demand for oxygen gas at the very time when the natural supply, from the minor density of the atmosphere, was constantly becoming lessened. That this is the real cause of the symptoms in question, no better proof can be offered or required than the fact that all these symptoms entirely disappear the instant the exertions have been discontinued by which they were occasioned. I can only assure the reader that at an elevation in a balloon of many thousand feet above the summit of Mont Blanc, Mr. Green has assured me that not the slightest personal sensation could be detected by him different from what he would have experienced had he been sitting quietly at home in his own study.

As to the inferences which may have been drawn from the consideration of experiments upon individuals by means of an air-pump, they are not a whit more admissible as evidence of the effects of excessive atmospheric elevation than the preceding. The circumstances of the two situations are essentially dissimilar; nor would it be possible by any artificial means to render them otherwise. Either the diminution of pressure is merely local, in which case it is unnecessary to point out the distinction; or if it be general, then does it inevitably implicate elements which do not enter into the constitution of the experiment conducted in the open air. The consumption of oxygen gas and the evolution of carbonic acid, are both essential results of the exercise of the respiratory

* From the experiments of Bostock, Menzies, Sir Charles Bell, and other physiologists, we learn that the average quantity of air contained in the lungs of a full-grown man is about two hundred and eighty cubic inches, whereof forty alone, or one-seventh of the whole, is drawn in and expelled at every ordinary respiration. Of this latter amount, according to the very careful analyses of Mr. Davy, from one-seventieth to one-hundredth disappears in the proceeding; assuming, however, one-eightieth as the mean diminution produced in the quantity actively employed, we obtain a result of half a cubic inch of oxygen, or one-five-hundred-and-sixtieth part of the actual contents of the lungs consumed in the process of respiration.

functions, which would very soon change the nature of any experiment in closed vessels, and subject the patient to consequences from which he would otherwise be free.

Upon the whole review of the case, therefore, I have thought it better to avoid all mention of the results in question, than by their admission upon dubious testimony render myself liable to the charge of having contributed to the perpetuation of error.

NAUTILI AND FLYING FISH.

## ARGONAUTA GONDOLA.

Madame Power first observed and published an account of (at Messina, 1834) the function of the brachial membranes in maintaining the shell of this animal in its proper relation to the body.

A Report to the British Association, in 1844, says:—

The fabled office of the brachial membranes, as "sails" to waft the argonaut along the surface of the ocean, and that of the attenuated arms, as "oars" extending over the sides of the boat, have afforded a favourite topic for poetic imagery and philosophical analogy during many ages; and the little hypothetical navigator of Nature's ship has been the object of the disquisition of the naturalist from Aristotle to Cuvier, and of the song of the poet from Callimachus to Byron.

### SONG OF THE STARS.

WHEN the radiant morn of creation broke,
And the world in the smile of God awoke,
And the empty realms of darkness and death
Were moved through their depths by His mighty breath;
And orbs of beauty, and spheres of flame,
From the void abyss by myriads came,
In the joy of youth, as they darted away
Through the widening wastes of space to play,
Their silver voices in chorus rung,
And this was the song the bright ones sung:

Away, away, through the wide, wide sky,
The fair blue fields that before us lie:
Each sun with the worlds that round us roll,
Each planet poised on her turning pole,
With her isles of green, and her clouds of white,
And her waters that lie like fluid light.

For the Source of Glory uncovers his face,
And the brightness o'erflows unbounded space;
And we drink, as we go, the luminous tides
In our ruddy air and our blooming sides;
Lo, yonder the living splendours play!
Away, on your joyous path, away!

Look, look, through our glittering ranks afar,
In the infinite azure, star after star,

How they brighten and bloom as they swiftly pass!
How the verdure runs o'er each rolling mass,
And the path of the gentle winds is seen,
When the small waves dance, and the young woods lean.

And see where the brighter day-beams pour,
How the rainbows hang in the sunny shower!
And the morn and the eve, with their pomp of hues
Shift o'er the bright planets and shed their dews!
And 'twixt them both, o'er the teeming ground,
With her shadowy cone, the night goes round.

Away, away!—in our blossoming bowers,
In the soft air wrapping these spheres of ours,
In the seas and fountains that shine with morn,
See, love is brooding, and life is born,
And breathing myriads are breaking from night,
To rejoice, like us, in motion and light.

Glide on in your beauty, ye youthful spheres!
To weave the dance that measures the years.
Glide on in the glory and gladness sent
To the farthest wall of the firmament,
The boundless visible smile of Him,
To the veil of whose brow our lamps are dim.

BRYANT.

## THE CONTRASTS.

One is frequently asked, "What are the sensations experienced in a balloon?" In reply to which I will contrast the two voyages described by Mons. Turgan, in his excellent manual, 'The Bright Side First, and then the Dark.' The first is a voyage made in 1850, by Mons. Turgan. At 5.20 P.M. on 22nd July, he left the Hippodrome at Paris, accompanied by Messrs. Green and Atkinson, and a Spanish lady, Madame de Lancy:—

. . . . I had thought that we should have risen with the rapidity of an arrow, and expected a strange motion, and that all objects would run together into a fantastic cascade. What, then, was my surprise to find that I did not move at all. The earth fled from beneath our feet; spectators, carriages, and houses diminished in our view, yet kept their outline sharp and clear, as if viewed through a doubly-concave lens. Soon the vast amphitheatre of the Hippodrome appeared no larger than a saucer, where microscopic objects were teeming like ants; the boulevards hardly six inches wide; and an omnibus, one could perfectly distinguish, appeared no larger than a snail, and to move as slowly.

Mr. Green threw out some ballast, and we rose to a height of one mile and a half, but were still below the clouds. The plain stretched its immense circle round the city, which contracted in proportion to the enlargement of the circle; roads, railways, canals, and rivers, all the arteries of terrestrial circulation gradually extended their white and black tracks. The Seine, of surpassing beauty, little by little unrolled its silver windings, each new turn showing we had added several hundred feet to the height we had already attained. We saw its limit always at the horizon, where it shone in the sun like a large diamond. It was now 6 P.M., and our altitude was three miles. An increased coldness could be felt; we refreshed ourselves with some Bordeaux, and passed a few minutes in enjoyable conversation, without further attention to the wonders within view.

We now entered the clouds, and new scenes attracted us. The sun's rays were reflected amidst these enormous masses of vapour, and caused singular mirages far exceeding the liveliest fancy. A few minutes later, and we beheld the most beautiful and thrilling spectacle that it is possible for man to contemplate; nothing on earth can be compared to the sublime magnificence of this scene; they only who have seen the snowy summits of the Alps may form an infinitely small idea of it.

Below and around us mountains of indescribable whiteness overtopped each other, and appeared crowded together, like a flock of sheep at a park-gate; then all at once the ethereal scenery changed; lakes and enormous sheets of water reflected brilliant rays; high white cliffs formed rugged banks and an horizon of mountains yellow like gold. Above extended the blue sky of a clearness that allowed the eye to penetrate infinite distance, and beneath, through some holes, something yellowish, greyish, tarnished—in fact, dirty. It is the earth. The earth at this time appeared to us a dreadful abode—a frightful sink. The beating of our hearts slow and energetic caused more life to circulate within us. Distances, colours, appearances, and speed, were all changed; and I felt as if I had entered another world. Mr. Green said he had never seen anything more beautiful, and commenced afresh to empty ballast. We rose to a height of five miles, when breathing became burdensome. It being now 6.35 P.M., and the sun near the horizon, it was time for us to descend. By one pull at the valve this was effected.

We were fortunate in passing through the clouds to see a parhelion (a double reflection of the balloon with

prismatic colours), a rare occurrence even in aerial voyages. It was then 6.50 P.M., and we were all sensible of the reflected heat from the clouds. Our descent was made with such rapidity that ballast thrown out descended in fine rain on our shoulders. A few minutes after, the bark of a dog reminded us of our approach to the earth; corn-fields, woods, and villages became again visible at the bottom of an immense yellow bowl, as the earth appeared to us. On what should we alight? was now the question. Would it be a church-spire or poplar? or should we step lightly into a clover-field or lawn? The last was our fate; and the descent was accomplished with success in a field of newly-mown grass. Many country people had been running after us, and now in the excitement of their capture became troublesome. Their amusement was extreme at hearing an unknown tongue. We were rescued from these difficulties by the good monks of the College of Juilly, who insisted on our coming into their establishment, where they provided us with an excellent supper, and lodged us for the night. Next day it was necessary for me to enter again into ordinary life, with two new and sincere wishes—one, to pass the rest of my life on the vast plains above the clouds; the other, less presumptuous but unfortunately as impossible, to study rhetoric for ever in the magnificent oasis of Juilly, an imposing monument to the architectural grandeur of the middle ages, where we received, on descending from the clouds, such noble and cordial hospitality.

The dark side is presented in Count Zambeccari's ascent from Bologna, in 1804:—

A bark of beauty on "the moon's" blue sea,
Winning its way among the billowy clouds,
Unoared, unpiloted, moved on; the sky
Was studded thick with stars, which glittering stream'd
An intermittent splendour thro' the heavens.
I turned my glance to earth; the mountain winds
Were sleeping in their caves, and the wild sea,
With its innumerous billows melted down
To one unmoving mass, lay stretch'd beneath
In deep and tranced slumber, giving back
The host above, with all its dazzling sheen,
To Fancy's ken, as tho' the luminous sky
Had rained down stars upon its breast. Suddenly
The scene grew dim: those living lights rush'd out.—ALARIC WATTS.

. . . . Then my spirit sunk! I thought my honour was lost! exhausted with fatigue! having eaten nothing all day! fever on my lips! despair in my soul! I rose at midnight—without other hope than that my balloon, which had much suffered from wear and tear, would not carry me very far.

Andreoli and Grassetti accompanied me. I intended to remain, if possible, at the same level until it was light, but I soon perceived a tendency to fall. I still hoped to descend without danger near Bologna, when of a sudden we rose with inconceivable rapidity, and the lamp it was intended should be seen from the earth, was extinguished; the feeble light of a lantern, however, still allowed us to look at the barometer. The insupportable cold, together with no food for twenty-four hours, caused me to fall into a sleep resembling death; Grassetti was affected in the same way; Andreoli only remained awake.

* * * * * * * *

We descended slowly through thick clouds, and when we were below them Andreoli heard the rolling of the waves. He told me this with alarm, and soon my own ears confirmed the truth. I instantly seized a bag of ballast, but before I could throw it out the car sunk in the water. During the first moment of alarm, we threw from us instruments, clothes, money, and all that could lighten the machine; still we did not rise, so we cut away such portions of the car as could be spared, and finally threw our lamp into the sea. Thus lightened, we rose with such extreme rapidity, that we could not hear each other's voice, even by hallooing. I felt sick, and

Grassetti's nose bled; as we had been wet to the skin, we were now covered with a coating of ice. After spending half an hour in the upper regions, we descended slowly, and fell again into the sea. It was then about 4 A.M. The night was still dark, and the sea tempestuous, and we were not in a situation to make many observations. We remained up to our waists in the water, with the waves washing over us. The balloon being more than half empty, the wind used it like a sail. We remained in this plight during the long hours that intervened till dawn, when we found ourselves opposite Pesaro, about four miles from the coast. We thought we should soon arrive there, when a land wind again carried us out to sea. The few fishing-boats near made away from us in alarm; but a smack at a distance recognised our globe as a balloon, and came alongside. The sailors threw us ropes, by which means we reached the deck perfectly exhausted. Our aerostat thus lightened again rose in spite of all endeavours to restrain it, and was soon lost in the clouds. We were conveyed to Pola, where we were received in the kindest manner. I was, however, obliged to have two fingers amputated that had been frost-bitten.

This distressing adventure occurred on the 8th of October, 1804, and was caused by a rash promise to the eager spectators at Bologna to ascend as soon as the balloon was filled, which was not accomplished till midnight. These toils and difficulties did not, however, deter the noble Count Zambeccari from continuing his experiments, till he lost his life in a Montgolfière, in the year 1812.

### THE AIR VOYAGE.—A VISION.

YE have heard of spirits that sail the air,
Like birds that float o'er the mountains bare,
Upborne with pinions of beauty on,
When the farewell light of day is gone,
And they gladly soar to the blue away,
As to catch the star's young travelling ray:
Till the arch of night,
Is tremblingly bright,
As if meteors shot on their upward flight.

Ye have heard of spirits that sail away
To realms that glisten with endless day,—
Where the clouds scarce lift their giant-forms,
In their far dim march to the land of storms;
Where the ocean of ether heaves around,
And silence and dew alone are found!
Where life is still,
By a boundless will,
As a sabbath around some echoless hill!

Methought I was borne through the measureless fields,
Where the silver moon and the comet wheels.
With a glorious thrilling of joy I went,
And a tide of life through my heart was sent,
As though a new fountain had burst control,
And bade its streams o'er my pulses roll;
And a shallop frail,
With a shadowy sail,
Hurried me on with a singing gale.

It went through my brain, this deep delight,
With a kindling sense of sound and sight;
And it seemed, as I rose, that the far blue air
Caught a hue of glory more richly rare
Than was ever revealed to earthly eyes,—
The cold, cold lustre of uppermost skies!
And still my bark went
Through the firmament,
As a thing to the walls of the universe sent.

When the sun rolled up from the burning sea,
Like a car of flame from immensity,
I felt his beams quiver along my frame,
When first o'er the clouds and stars they came;
And the light dropping orbs I had slumbered among,
Their dim dewy eyes o'er creation hung,
As each beautiful ray
Sunk sadly away,
To the inner home of the high-blue day!

Then I sailed far off to the thundering clouds,
That loomed on the air like spirits in shrouds,
My vessel, sunk on their fleecy pillow,
Seemed a shadowy bark on a dreamy billow;
And I floated through seas of visioned things,
Where the waking breezes point their wings,
While far below,
'Mid the lightning's glow,
I heard the dull sounds of the tempest go.

Then storm-clouds crossed my glowing track,
And launched me on through the hurrying rack,
Till a new creation seemed to rise,
In beauty all over the opening skies;
And the spirits that passed on the wings of night,
As they took their farewell feathery flight,
Poured melody out,
Like the far-off shout
Of music that dies on its airy route!

G. MELLEN.

The following (from 'Good Words') is Mr. Glaisher's graphic account of his journey in a balloon, six miles high:—

When it is intended to ascend five or six miles high, the balloon is but little more than one-half full; because gas expands to double its bulk at three and three-quarters miles high, and to three times its bulk at five or six miles; to fill the balloon before starting would therefore be to waste gas, and possibly annoy the occupants of the car by its escape from expansion at the neck of the balloon.

The processes of expansion and contraction are constantly going on, and varies with every variation in the height of the balloon. On passing from a cloudy state of the sky to a clear one, it is necessary to go through the clouds, during which time the cordage and the balloon become bedewed with moisture, so increasing its load; but on breaking into bright sunshine, the expansion, from the sun shining on the balloon, causes it to rise rapidly; two agencies being at work, viz. increase of heat and loss of weight by evaporation. But in passing from bright sunshine into cloud, the gas becomes contracted by loss of heat, and the balloon every instant absorbs moisture and so increases its load; both causes combining to make the balloon descend with great rapidity.

Moreover, this continual variation in the expansion or contraction of the gas causes perpetual changes in the shape and course of the balloon, and so necessitates the constant attention, skill, and judgment of the aeronaut.

In the case of the extreme high ascents, the operations were performed where no eye but mine could witness them.

At the same time, a journey through the air, reaching to the height of five or six miles, is of so rare an occurrence, the position so novel, the phenomena which present themselves so peculiar, that nothing short of personal experience could give a correct knowledge of them, that I propose to give a descriptive account of a journey through the air, blending the experiences of the several ascents I have made somewhat together.

### BEFORE LEAVING THE EARTH.

Imagine the balloon somewhat more than half inflated, eager for flight, with only one link connecting it with the earth, viz. a rope attached to an instrument called a liberating iron or catch.

When all the ballast, instruments, and everything else are placed in the car, with the grapnel attached outside, so as to be readily detached, and these amount to 4000 pounds, the balloon is brought to a *nice* and *even* balance, so that the addition of twenty pounds would prevent it from rising, but if removed would give it the required ascending power.

When all is ready, Mr. Coxwell, with his hand upon the catch, looks up at the sky, and is apparently staring at vacancy, but he is not. If the sky be partially cloudy, he watches till he is midway between the cloud that has passed and that which is coming, so that he may have a clear sky, and at least see the earth beneath, and avoid, if possible, passing through a cloud, though it may be cloudy all round; for the cloud which preceded will always precede, and that which follows will always follow. Nor is that all; he knows that in every wind, how strong soever it may be, there are periods of calms, and if he can start in one of them he avoids much rotatory motion; so he awaits for an opportune moment for a fair start, to combine these two states together, if possible.

### THE DEPARTURE.

When the sun shines, the wind lulls, and the balloon stands proudly erect; the favourable moment arrives; the catch is pulled, and we are free. We are free, but not only so, we are in profound repose; no matter how violent soever the wind may be, no matter how agitated the balloon may have been swaying to and fro, now on this side, now on that, with sudden and violent action, notwithstanding all the efforts of the many individuals who were struggling to hold it; all agitation in a moment ceases, and we are in perfect stillness, without any sense of motion whatever, and this continues throughout our entire flight.

Once away, we are both immediately at work; we have but little time for graceful acknowledgments to cheering friends. Mr. Coxwell proceeds to put the car in order, and accordingly looks to it, to his balloon, and to the course we are taking; and I must get my instruments in order. Without delay, therefore, at once place them in their situations, adjust them, and take a reading as soon as possible.

In a few minutes we are from 1000 to 2000 feet high; Mr. Coxwell looks intently upwards, to see how the huge folds of the balloon fill into the netting. If we have started from a town, its busy hum attracts our attention, and a glance shows us the many upturned faces in every street, and the town itself, which looks like an engineer's model in motion; and the now fast fading cheers of our assembled friends next attract our attention, and another glance shows us the quickly diminishing forms of the objects we so recently left.

### REACHING THE CLOUDS.

On approaching the clouds, Mr. Coxwell recommends me to take a farewell peep at the earth; and, as I do this, the clouds receive us, at first in a light gauze of vapour, and then in their chilly embrace, where I examine their structure, note the temperature of the dew-point particularly. Shortly it becomes lighter, the light gradually increasing, till it is succeeded by a flood of light, at first striking, then dazzling; and we pass out of a dense cloud, to where the clouds open out in bold and fantastic shapes, showing us light and shade and spectral scenes, embellished with prismatic colours, disporting themselves around us in wild grandeur, till at length we break out into brilliant sunshine, and the clouds roll away into a perfect sea of vapour, obscuring the earth entirely; then in the line from the sun passing us, we see the shadow of the balloon and car and ourselves upon the clouds, very large and distinct, with encircling ovals of rainbow tints; forming altogether a wonderful scene—a wonderful contrast to that of their lower surface.

### ABOVE THE CLOUDS.

When approaching the height of three miles, Mr. Coxwell directs my attention to the fact, that the balloon is full, and the gas is issuing from the safety-valve. He then directs my attention to the fit and proportions of the netting. I find the gas, which was before cloudy and opaque, is clear and transparent, so that I can look right up the balloon, and see the meshes of the network showing through it; the upper valve, with its springs and line, reaching to the car, and the geometrical form of the balloon itself. Nor is this an idle examination.

I have already said, that in passing through the cloud the netting would gather moisture, augmenting the weight of the balloon; if this should not all have evaporated, the network would have become frozen, and be as wire-rope; so that, if the diamond shape of the netting when under tension, and the form of the crown of the balloon be not symmetrical, the weight might not be equally distributed, and there would be danger of it cutting the balloon. A sense of security, therefore, follows such an examination.

### THREE MILES HIGH.

A stream of gas now continually issues from the neck, which is very capacious, being fully two square feet in area, which is always left open; and after a time I see Mr. Coxwell, whose eye has been continually watching the balloon, pass his fingers over the valve-line, as if in readiness to pull the cord. I look inquiringly at him. He says, I have decided to open the large upper valve, and carefully explains why. "The tension," he says, "on the balloon is not greater than it would bear in a warm stratum of air with safety; but now that we are three miles up with a chilled balloon, it is better to allow some to escape at the top, as well as a good deal from the bottom."

### FOUR MILES HIGH.

We are now far beyond the reach of all ordinary sounds from the earth. A sea of clouds is below us, so dense that it is difficult to persuade ourselves that we have passed through them. Up to this time, little or no inconvenience is met with; but on passing above four miles, much personal discomfort is experienced: respiration becomes difficult; the beating of the heart at times is audible; the hands and lips become blue, and at higher elevations the face also; and it requires the exercise of a strong will to make and record observations.

### FIVE MILES HIGH.

Before getting to our highest point, Mr. Coxwell counts the number of his sand-bags, and calculates how much higher we can go, with respect to the reserve of ballast necessary to regulate the descent.

Then I feel a vibration in the car, and, on turning round, see Mr. Coxwell in the act of lowering down the grapnel; then looking up at the balloon; then scanning the horizon, and weighing apparently in his mind some distant clouds, through which we are likely to pass in going down.

A glance suffices to show that his mind is made up how much higher it is prudent to rise, and how much ballast it is expedient to preserve.

### SIX MILES HIGH.

The balloon is now lingering, as it were, under the deep blue vault of space, hesitating whether to mount higher, or begin its descent without further warning. We now hold consultation, and then look around, giving silent scope to those emotions of the soul which are naturally called forth by such a wide-spread range of creation.

Our course is now about to change, but here I interpose with "No, no; stop! not yet; let us remain so long, that the instruments are certain to take up their true readings, so that no doubt can rest upon the observations here. When I am satisfied, I will say, Pull."

### THE HIGHEST POINT.

Then, in silence, for here we respire with difficulty, and talk but little; in the centre of this immense space; in solitude, without a single object to interrupt the view for 200 miles or more all round; abstracted from the earth; upheld by an invisible medium; our mouths so dry we cannot eat; a white sea below us; so far below, we see few, if any, irregularities. I watch the instruments, but forcibly impelled again, look round from the centre of this immense vacuity, whose bounding line is 1500 miles, including an area of 130,000 square miles.

### BEGINNING OF THE DESCENT.

When I find no further changes are proceeding, I wave my hand and say, "Pull." A deep resonant sound is heard overhead; a second pull is followed by a second report that rings as with shrill accompaniment down the very sides of the balloon. It is the working of the valve which causes a loud booming noise, as from a sounding-board, as the springs force the shutters back.

But this sound in that solitary region, amid a silence so profound that no silence on earth is equal to it; a drum-like sound meeting the ear from above, from whence we usually do not hear sounds, strikes one forcibly. It is, however, one sound only; *there is no reverberation, no reflection;* and this is characteristic of all sounds in the balloon, *one clear sound*, continuing during its own vibrations, then gone in a moment. *No sound* ever reaches the ear a second time. But though the sound from the closing of the valve in those silent regions is striking, it is also cheering, it is reassuring, it proves all to be right; that the balloon is sound, and that the colder regions have not frozen tight the outlet for gas.

### ONE OR TWO MILES DOWN.

We have descended a mile or more, and our feelings improve with the increase of air and warmth. But silence reigns supreme. Mr. Coxwell turns his back upon me, scanning the distant cloudscape, speculating as to when and where we shall break through, and catch sight of the earth.

### APPROACHING THE CLOUDS FROM ABOVE.

On nearing the clouds we observe the counterpart of our own balloon reflected upon them, at first small in size, momentarily increasing. This spectral balloon is charming to look upon, and presents itself under a variety of aspects, which are magnified or diminished by the relative distance of our balloon from the clouds, and by its position in relation to the sun, which produces the shadow. At midday it is deep down, almost underneath; but it is more grandly defined towards evening, when the golden and ruby tints of the declining sun impart a gorgeous colouring to cloudland. You may then see the spectre balloon magnified upon the distant cloud-tops, surrounded with three beautiful circles of rainbow tints. Language fails utterly to describe these illuminated photographs, which spring up with matchless truthfulness and choice decoration.

### DIPPING INTO THE CLOUDS.

Just before we enter the clouds, Mr. Coxwell having made all preparations for the descent, strictly enjoins me to be ready to put up the instruments, lest, when we lose the powerful rays of the sun, and absorb the moisture of the lower clouds, we should approach the earth with too great rapidity.

We now near the confines of the clouds, see the spectral balloon approaching us, nearly as large as our own, and just then dip swiftly into the thickest of them. We experience a decided chill, and hear the rustling of the collapsing balloon, which is now but one-third full; but cannot see it, so dense is the mass of vapour; one, two, three, four, or more minutes pass, and we are still in the cloud: how thick it must be, considering the rapidity of the descent!

### BELOW THE CLOUDS.

Presently we pass below, and the earth is visible. There is a high road intersecting green pastures; a piece of water like polished steel. An open country lies before us; a shout comes up and announces that we are seen, and all goes well, save the rapidity of the descent, caused by the thick clouds through which we have just passed, shutting us out from the sun's rays, and loading us with moisture. Mr. Coxwell counteracts this by means of the

ballast, and streams out one bag, which appears to fly up instead of falling down; now another, and another he casts forth, but still it goes up, till the wayward balloon is reduced within the bounds of moderation. Mr. Coxwell exultingly exclaims, "*I have it now under perfect control, with sand enough, and to spare.*"

Glad to find the balloon checked, with the prospect of an easy descent, I read the several instruments as quickly as I can, noticing at the same time the landscape below, charming in its constant variation, rich with its mounds of green foliage, fields of various shades of green, intersected by roads, rivers, rivulets, &c.; and all this is seen with a distinctness superior to that on the earth; the line of sight is through a purer and less dense medium, everything seems clearer, though smaller. At the height of four miles over Birmingham, both Mr. Coxwell and myself distinguished readily the New Street station, and the several streets in the town, with the naked eye. After descending slowly for a little time, Mr. Coxwell selects a spot for our descent, distant then two or three miles. The current near the earth, which is often stronger than the upper, wafts us merrily in that direction.

NEARING THE EARTH.

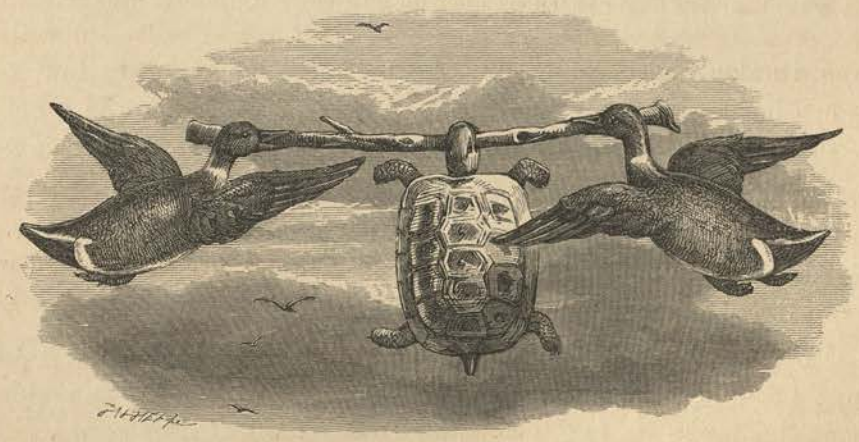
We are but a few hundred feet from the earth, when Mr. Coxwell requests me to put up the instruments, and he will keep on that level till I am ready. He throws out a little more sand, and I pack up the instruments in their wadded cases. Mr. Coxwell's eye is on the balloon—the course it is taking with respect to the inclination of its descent on the spot where he has chosen to land. Shortly he calls out, "Are you all right?" "All right," I respond. "Look out, then, and hold fast by the ropes; the grapnel will stop us in the large meadow, with the hedge-row in front.

AT ANCHOR.

Sure enough the grapnel catches in the hedge, and once again we are connected with the earth by one link. The valve-line is drawn, and a little gas is allowed to escape. The sheep, which have been watching the descending balloon, huddle together and run away; and the cattle, becoming very frightened, place their tails horizontal, and wildly scamper off in all directions.

ON THE EARTH.

Villagers break through the hedges on all sides, and we are soon surrounded by an agricultural crowd, some of whom take hold of the rope attached to the grapnel, and, as directed, pull us down, or hold it whilst we float to the centre of a field. The valve is again opened, gas is allowed to escape by degrees, nothing is allowed to be touched till the reduced buoyancy of the balloon permits the removal of the instruments. The car is gradually lightened, till finally we step out, when a group of friends from among the gentry draw up near us; and although some few may question whether we belong to this planet, or are just imported from another, all doubt on the subject is soon set at rest, and we are greeted with a hearty welcome from all when we tell our story,—how that we have travelled the realms of space, not for the purposes of pleasure, not from motives of curiosity, but for the advancement of science and the good of mankind.



WILD DUCKS AND TORTOISE.

I am eaglet born, and can drink in
The sunlight when the blinking owls go darkling,
Dazzled and blinded by the day.

MITFORD.

# CHAPTER XI.

## CARICATURE, AND THE RIDICULE THIS SCIENCE HAS UNDERGONE.

" Aristophanes only gives expression to public hatred and to public scorn, in ridiculing and misrepresenting the physical inquirers of his day,—men said to occupy themselves in

' Walking on air, and contemplating the sun.' "

LEWIS, *Life of Aristotle.*

WHEN A MAN LAUGHS HE IS NOT VERY MERRY, BUT VERY PROUD, *HOBBES* — CYRANO DE BERGERAC — " MAKING USE OF THE MORNING MIST " — THE BEAUTIES OF THE LUNAR COUNTRY — A SOLAR BEING — A LUNAR ARREST — RETURNS TO ITALY — DEAN SWIFT — PEGASUS IN HARNESS, *SCHILLER* — A FLYING VISIT, *ALBERT SMITH* — PLEASURE TRIPS FOR THE PEOPLE, *ALBERT SMITH* — " CROTCHETS IN THE AIR " — " THE PLANET-EARTH " — BALLOONICISMS — NO RUFFLING OF BUTTERFLIES' WINGS TO PUT YOUR FANCIES TO FLIGHT — " TWELVE TIMES THE HEIGHT OF ST. PAUL'S " — THE EARTH " WENT DOWN " — PORSON'S SKULL — A FRIEND'S CHAMBERS ON THE SECOND FLOOR — " HALFWAY DOWN " — DOES BOSWELL SAY JOHNSON WAS EVER IN A BALLOON — THE PENNY DICTATOR — THE " SCIENCE " OF BALLOONING — A HIGHLANDER'S KNOWLEDGE OF KNEE-BUCKLES — RAISING THE WIND — " BABBAGE'S MACHINE " — WATERLOO BRIDGE — £00,000 — THE STATUE OF GEORGE III. — NATURAL, MORAL, AND POLITICAL PHILOSOPHY = IFS — " JULIUS CÆSAR AND THE TOWER OF LONDON " — " GLORIOUS VICTORY " — THE JEWEL OFFICE — HALL OF THE GOLDSMITHS' COMPANY — NATIONAL GALLERY AND NEWGATE — DIG, DIG, DIG — QUARTZ AND SILICA — £0,000,000 — " BUT LONDON SHOWED ANOTHER SIGHT " — DRAWN IN LINES OF FIRE — A HINT FOR SOMEBODY — CAMPS AND CABINETS' DIVISIONS — THE EAGLE AND CHILD — FLAT AS A PANCAKE — A REVERIE — HISTRIONOMETER ONE DEGREE ABOVE THE MEDIOCRITY POINT — THE PUFFSTER — THE PUBLIC IS THE MAINSTAY — EDGAR POE — ROTTERDAM — HANS PFAALL — THE BURGOMASTER — THE ASTRONOMICAL COLLEGE — " THE MOON'S ACTUAL DISTANCE FROM THE EARTH " — TO BE REACHED IN 161 DAYS, AT THE RATE OF SIXTY MILES AN HOUR — LIFE SUSTAINED IN A VACUUM — THE CAT EYES THE PIGEONS WITH AN AIR OF NONCHALANCE — " SHOULD THE KITTENS SUFFER IN AN EQUAL DEGREE AS THEIR MOTHER? " — " THE SHORES OF THE ATLANTIC OCEAN " — " PUSS MAKES A HEARTY MEAL " — 132,000 FEET, OR TWENTY-FIVE MILES ABOVE THE SEA — THE ICE OF THE NORTH POLE — " ASCEND IN A STRAIGHT LINE FROM THE POLE " — 7254 MILES ABOVE — DIMINUTION OF THE EARTH'S APPARENT DIAMETER — " THE EXACT PLANE OF THE LUNAR ELLIPSE " — THE " BOULEVERSEMENT " — " NO TIME TO BE LOST IN LIGHTENING THE MACHINE " — " THE EARTH APPEARS LIKE A COPPER SHIELD, BELTED WITH TROPICAL AND EQUATORIAL ZONES " — " THE DUTCH PROFESSOR DROPS HIS PIPE."

" ALL men (says Dunlop) have, more or less, a propensity to satire and ridicule. This tendency has its origin in self-love, which naturally leads us to indulge in a belief of our own superiority over the rest of our species. It is in satire and ridicule that this feeling receives its most frequent gratification; and, spite of the objections of Beattie, nothing can, in many instances, be more just than the reflection of Addison on the well-known theory of Hobbes, that when a man laughs he is not very merry, but very proud."

Could a better laughingstock be found than aerostation, in which the failures are so obvious? One of the first instances we meet with is a masterpiece of ridicule by *Cyrano de Bergerac*, who was born in Perigord in 1620, of whose amusing works,—entitled ' *Histoire Comique des Estats et Empire de la Lune*;' also ' *Les Estats et Empire du Soleil*,'—*Dunlop*, in his ' *History of Fiction*,' gives this concise abstract:—

I shall give some account of the first and best of these works, as it is, with much probability, supposed to have influenced Swift in his adoption of the same method of writing, and has acquired a high reputation among the compositions of this description.

Both the works of Cyrano were posthumous, and are in some parts mutilated. The first of them, 'De la Lune,' was published by a Mons. de Bret, who tells us, in his preface, that the father of Cyrano, "estoit un bon vieux Gentilhomme assez indifferent pour l'education de ses enfants." He also informs us, that the young man entered into the army, and became the most famous duellist of his age, having fought more than a hundred times, without one of his rencounters having been in his own quarrel. He was wounded at the siege of Arras in 1640, and in consequence of wounds, early dissipation, fatigue, and chagrin, died in the thirty-fifth year of his age.

The notion of writing an account of an imaginary excursion to the moon, seems partly to have been suggested by the circumstance of the lunar world having become an object of curiosity among the philosophers of the day. In contradiction to the old opinion of the peripatetics, that the moon could not be a habitable world, on account of its unchangeable nature, Gilbert ('Philosoph. Magnet,' c. 13 and 14), Henry Leroy and Francisco Patrizio explained at great length the appearances on which they founded an opposite system, while Hevelius, in his 'Selenographia,' and Gassendi, indulged in some serio-comic speculations with regard to lunar rivers and mountains.

Hence Cyrano conceived the intention of representing, in a humorous point of view, those chimeras which some of his contemporaries had too gravely treated. To this he joined the plan of ridiculing the pedantry, the scholastic disputations of the age, and that deference to authority which was so long the bane of science. The notion of conveying this satire in the form of an imaginary excursion to the moon, was probably suggested by the Spanish work of Dominico Gonzales, of which a French translation was subsequently published, under title of 'L'Homme dans la Lune, ou le Voyage Chimerique fait au Monde de la Lune, nouvellement decouvert par Dominique Gonzales, Aventurier Espagnol, autrement dit le Courier Volant.' Bayle is mistaken in supposing that Bergerac was in any degree indebted to the 'Voyage to Australasia,' published under the fictitious name of Jacques Sadeur. That production is no doubt a 'Voyage Imaginaire,' but the two works have little resemblance, and Bergerac was dead more than twenty years before the voyage of Sadeur was written by the infamous Gabriel de Foigni.

Bergerac begins the relation of his voyage to the moon by an account of a conversation which led him to meditate on that luminary. His contemplations ended in planning some method to go thither; and, accordingly, having filled some phials with dew, he fixed them round his person, so that the heat of the sun, by attracting the dew, raised him from earth. He lighted in Canada, and gives us some astronomical conversations he there held with the governor. It would be needless to relate the method which he afterwards adopted to journey to the moon, in a species of elastic machine (of which the construction is not very clearly described), or to detail the circumstances which at length rendered his flight successful. The fiction contrived by Bergerac to account for his flight,

THE MORNING DEW.

is much less happy than that of Dominico Gonzales, who feigns that he had been drawn to the moon by ganzars—birds of passage which winter in that luminary.

After a long ascent, Cyrano finds himself between two moons, of which our earth was the largest, and at length he reaches the sphere of activity at the moon, towards which his feet then turn. This does not happen till he is considerably nearer the moon than the earth, and it is curious that he uses reasoning on the occasion not unlike what would be now employed by a Newtonian.—"Car, disois-Je en moy-mesme, cette Masse (la lune) estant moindre que la nostre, il faut que la sphere de son activité ait aussi moins d'estendüe, et que par consequent J'aye senty plus tard la force de son centre."

At the entrance into the moon, a *hiatus* occurs in the work, of which there are several instances in the course of it, some of which, perhaps, were owing to the author himself, where a difficulty occurred not easily to be surmounted, and others probably to the editor, when a passage presented itself which was too free or indelicate. The beauties of the lunar country are painted with considerable felicity, though the description is not free from the affectation which was common among French authors in the days of Bergerac.—"Là le Printemps compose toutes les saisons; là les ruisseaux par un agreable murmure racontent leurs voyages aux cailloux; là mille petits gosiers emplumez font retentir la forest au bruit de leurs melodieuses chansons; et la trémoussante assemblée de ces divins musiciens est si generale, qu'il semble que chaque feuille dans les bois ait pris la langue et la figure d'un Rossignol—on ne sçait si les fleurs agitées par un doux Zephire courent plutost apres elles-mesmes, qu'elles ne fuyent pour eschapper aux caresses de ce vent folâtre."

After walking half a league in a forest of jessamine and myrtle, Bergerac espies a beautiful and majestic youth reposing in the shade. With this personage, who had once been an inhabitant of our world, he enters into a conversation, of which we have only fragments. He is soon afterwards less fortunate, in meeting with the aborigines of the country, who are described as huge naked men, twelve cubits high, walking on all fours. By these he is considered as a little monster, and he is consigned to a mountebank, to be exhibited, like Gulliver, as a show—"Ce Basteleur me porta à son logis, où il m'instruisit à faire le Godenot, à passer les culbutes, à figurer des grimaces: et les après dinées il faisoit prendre à la porte un certain prix de ceux qui me vouloient voir. Mais le ciel flechy de mes douleurs, et fasché de voir prophaner le Temple de son maître, voulut qu'un jour comme J'estois attaché au bout d'une corde, avec laquelle le Charlatan me faisoit sauter pour divertir le monde, J'entendis la voix d'un homme qui me demanda en Grec qui J'estois. Je fus bien estonné d'entendre parler en ce pais-là comme en notre monde. Il m'interrogea quelque temps; Je luy repondis, et luy contay en suite généralement toute l'entreprise et le succès de mon voyage: il me consola, et Je me souviens qu'il me dit: Hé bien, mon fils, vous portez enfin la peine des foiblesses de vostre monde. Il y a du vulgaire icy comme là qui ne peut souffrir la pensée des choses où il n'est point accoustumé. Mais sçachez qu'on ne vous traitte qu'à la pareille; et que si quelqu'un de cette terre avoit monté dans la vostre, avec la hardiesse de se dire homme, vos sçavans le feroient estouffer comme un monstre. Il me promit en suite qu'il advertiroit la Cour de mon desastre."

This friendly personage alike disclaimed a terrestrial and lunar origin; he informs Bergerac that originally he had been a native of the sun, which, being overstocked with inhabitants, occasionally sent out colonies to the neighbouring planets. He had, it seems, been commissioned to our earth, and in his youth had been known in Greece as the demon of Socrates. In Rome he had addicted himself to Brutus, but had at length preferred a lunar to a terrestrial residence, for which he assigns various reasons:—"C'est que les hommes y sont amateurs de la verité, qu'on n'y voit point de Pedans, que les Philosophes ne se laissent persuader qu'à la raison, et que l'authorité d'un sçavant, ny le plus grand nombre, ne l'emportent point sur l'opinion d'un bateur en grange, quand il raisonne aussi fortement. Bref en ce pais on ne conte pour insensez que les Sophistes et les Orateurs. Je luy demanday combien de temps ils vivoient; il me repondit trois ou quatre mille ans."

With this solar being, Bergerac enters into philosophical conversation, and several very sublime discussions ensue, which are fortunately interrupted by his friend the exhibiter. "Il en estoit là de son discours, quand mon Basteleur s'apperçeut que la chambrée commençoit à s'ennuyer de mon jargon qu'ils n'entendoient point, et qu'ils prenoient pour un grognement non articulé: il se remit de plus belle à tirer ma corde pour me faire sauter jusques à ce que les spectateurs étant saouls de rire et d'asseurer que J'avois presque autant d'esprit que les bestes de leur pais, ils se retirerent chacun chez soy."

The chief inconvenience felt by Cyrano, during the first period of his lunar residence, was the want of provisions, for the inhabitants of the moon live by the odour of savoury viands; a mode of subsistence also attributed to them in the 'True History of Lucian,' which evinces our author's imitation of the works of the Grecian

satirist. Cyrano, however, at last succeeds in making them understand, that some ing more substantial than the mere steam or exhalations of feasts was necessary for his subsistence.

At length Cyrano was conducted to court by the friendly demon, where, after much reasoning, it was concluded that he was the female of the queen's little animal, who, in consequence was ordered to be introduced to him. Accordingly, in the midst of a procession of monkeys in full dress, a little man arrived. "Il m' aborda," says Bergerac, "par un *Criado de vouestra merced;* Je luy riposté sa reverence à peu pres en mesmes termes." This gentleman was Dominico Gonzales, the Castilian, who had travelled thither with the Ganzars; and this circumstance, by the way, is a proof that the work of Gonzales was the prototype of that of Cyrano, as his was evidently of 'Gulliver's Voyage to Brobdignag.' Dominico had immediately on his arrival been classed in the category of monkeys, as he happened to be clothed in the Spanish mode, which the inhabitants of the moon had fixed on for the fashionable attire of their monkeys, as the most ridiculous, which, after long meditation, they had found it possible to devise. Cyrano being considered by the lunar sages as the female of the same class of monkeys of which Dominico was the male, they were confined together, and have long and pretty tiresome discourses concerning elementary principles, the possibility of a vacuum, and other investigations, which were fashionable subjects of discussion among philosophical inquirers in the days of Bergerac. "Voilà," says he, "les choses à peu près dont nous amusions le temps: car ce petit Espagnol avoit l'esprit joly. Nostre entretien toute fois n'estoit que la nuit, à cause que depuis six heures du matin jusques au soir, la grande foule du monde qui nous venoit contempler à nostre logis nous eust destourné; Car quelques-uns nous jettoient des pierres, d'autres des noix, d'autres de l'herbe: Il n'estoit bruit que des bestes du Roy, on nous servoit tous les jours à manger à nos heures, et le Roy et la reine prenoient eux-mesmes assez souvent la peine de me taster le ventre pour connoistre si Je n'emplissois point, car ils bruloient d'une envie extraordinaire d'avoir de la race de ces petits animaux. Je ne sçais si ce fut pour avoir esté plus attentif que mon masle a leurs simagrées et à leurs tons, mais J'appris plustost que luy à entendre leur langue, et à l'escorcher un peu."

The circumstance of Cyrano acquiring some knowledge of the language of the country, instead of being favourable to him, exposed him to inconvenience and persecution, as some free-thinkers began to allege that he was endued with reason. This was most furiously opposed by the more orthodox and accredited sages, who maintained that it was not only foolish, but a most horrid impiety, to suppose that a creature which did not walk on all-fours, could be possessed of any species of mental intelligence. "Nous autres," argued they, "marchons à quatre pieds, parce que Dieu ne se voulut pas fier d'une chose si precieuse à une moin ferme assiette, et il eut peur qu'allant autrement il n'arrivast malheur à l'homme, c'est pourquoy il prit la peine de l'asseoir sur quatre piliers, afin qu'il ne pût tomber: mais dedaignant de se mesler de la construction de ces deux brutes, il les abandonna au caprice de la Nature, laquelle ne craignant pas la perte de si peu de chose, ne les appuya que sur deux pattes."

But the principal argument against the rationality of Cyrano and his male, and on which the lunar sages particularly piqued themselves, was, that these animals possessed the *Os Sublime*, which the sages of our earth, in their discussions against quadrupeds, rightly consider as a pledge of immortality: "Voyez un peu outre cela," continued the lunar philosophers, "comment ils (Cyrano and the Spaniard) ont la teste tournée devers le Ciel: C'est la disette ou Dieu les a mis de toutes choses, qui l'a scitué de la sorte, car cette posture supliante témoigne qu'ils se plaignent au ciel de celuy qui les a creez, et qu'ils luy demandent permission de s'accommoder de nos restes. Mais nous autres nous avons la teste panchée en bas pour contempler les biens dont nous sommes seigneurs, et comme n'y ayant rien au ciel à qui notre heureuse condition puisse porter envie."

The result of the philosophical conferences concerning Cyrano was, that he must be a bird—a discovery on which the sages greatly plumed themselves; he was accordingly enclosed in a cage, and entrusted to the queen's fowler, who employed himself in teaching his charge as we do linnets. Under this person's auspices, the progress of Cyrano was such that the disputes concerning his rationality were renewed, and the consequence was, that those sages who defended the orthodox side of the question, having considerably the worse of the argument, were obliged—"de faire publier un Arrest par lequel on defendoit de croire que J'eusse de la raison, avec un commandement très-exprès à toutes personnes de quelque qualité qu'elles fussent, de s'imaginer, quoy que Je pusse faire de spirituel, que c' estoit l' instinct qui me le faisoit faire."

To those who are acquainted with the history of philosophy, and the state of opinions in the days of Bergerac, there will appear considerable merit in the satire which has just been exhibited. The supporters of the systems of Aristotle had at one time (ridiculous as it may seem) procured an *Arrêt* at Paris, to prevent his doctrines being

contested; and some of his admirers, enraged at the shock which Descartes, Gassendi, and other philosophers in France at this time gave to his opinions, were desirous of resorting to a similar expedient.

In spite, however, of the Lunar *Arrêt*, the controversy grew so warm, that, as a last resource, Cyrano was ordered to appear before an assembly of the states, in order to judge of his rational powers. The examiners interrogated him on some points of philosophy, and refuted the opinions which he expressed in his answers, "de sorte que n'y pouvant répondre, J'alleguay pour dernier refuge les principes d'Aristote, qui ne me servirent pas davantage que les Sophismes, car en deux mots ils m' en decouvrirent la fausseté. Cet Aristote, me dirent ils, dont vous vantez si fort la science, accommodoit sans doute les principes à sa Philosophie, au lieu d'accommoder sa Philosophie aux principes. Enfin comme ils virent que Je ne leur clabaudois autre chose, sinon qu'ils n'estoient pas plus sçavans qu'Aristote, et qu'on m'avoit defendu de disputer contre ceux qui nioient les principes; ils conclurent tous d'une commune voix, que Je n'estois pas un homme, mais possible quelque espèce d'Austruche, si bien qu'on ordonna à l'Oyseleur de me reporter en cage. J'y passois mon temps avec assez de plaisir, car à cause de leur langue que Jé possedois correctement, tout la cour se divertissoit à me faire jaser. Les Filles de la Reine entr'autres fouroient toujours quelque bribe dans mon panier; et la plus gentille de toutes ayant conceu quelque amitié pour moy, elle estoit si transportée de joye, lorsqu'estant en secret, Je l'entretenois des moeurs et des divertissemens des gens de nostre Monde, et principalement de nos cloches, et de nos autres instruments de musique, qu'elle me protestoit les larmes aux yeux que si jamais Je me trouvois en estat de revoler en nostre Monde, elle me suivroit de bon coeur."

This lady continues to manifest much attachment to Cyrano, and her affection reminds us of the love of the fair Glumdalclitch for Gulliver in Brobdignag.

At length his friend, the demon of Socrates, procures the deliverance of Cyrano, who now narrowly escapes being condemned to death for impiety, in maintaining that our earth was not merely a moon, but an inhabited world. This had been oppugned with so much zeal, and so many good arguments by the sages, that Cyrano, in revenge, asserted that he had come to opine that their earth was not an earth but a moon.—"Mais, me dirent-ils tous, vous y voyez de la terre, des rivières, des mers, que seroit-ce donc tout cela? N'importe, repartis Je, Aristote asseure que ce n'est que la Lune; et si vous aviez dit le contraire dans les classes ou J'ay fait mes estudes, on vous auroit sifflé. Il se fit sur cela un grand eclat de rire, il ne faut pas demander si ce fut de leur ignorance: Mais cependant on me conduisit dans ma cage." In fine, previous to his deliverance from this second confinement, Cyrano was obliged to make an *Amende*, and to proclaim publicly in the principal parts of the city,—"Peuple, Je vous declare que cette Lune-cy n'est pas une Lune, mais un Monde, et que ce Monde de là bas n'est pas un Monde, mais une Lune. Tel est ce que le Conseil trouve bon que vous croyez."

After the deliverance of Bergerac, we are presented with a number of philosophical disquisitions which he held with the demon and his friends. Among other topics, the arrival of a person of quality, decked out in a particular manner, gives rise to a discussion, which has been seized upon by Sterne:—"Cette coustume me semble bien extraordinaire, repartis-Je, car en nostre monde la marque de noblesse est de porter une Espée. Mais l'Hoste sans s'emouvoir: O mon petit homme, s'ecria-t'il, quoy les grands de vostre monde sont si enragez de fair parade d'un instrument qui designe un boureau, et qui n'est forgé que pour nous détruire, enfin l'ennemy juré de tout ce qui vit; et de cacher au contraire ce sans qui nous serions au rang de ce qui n'est pas, le Promethée de chaque animal, et le raparateur infatigable des foiblesses de la nature. Malheureuse contrée, ou les marques de génération sont ignominieuses, et où celles d'anéantissement sont honorables." *

At length Cyrano, after performing a tour of the moon, is conducted from that luminary to earth, in the arms of the demon, who places him on the acclivity of a hill, and disappears. Some Italian peasants, whom he meets, cross themselves in great terror, but at length conduct him to a village. Here he is assailed by a prodigious barking of dogs, who, smelling the odour of the moon, against which they were accustomed to bark, keep up an incessant clamour. By walking a few days on a terrace in the sun, in order to purify himself of the smell, Cyrano forms a truce with his canine foes, visits Rome, and at length arrives at Marseilles.

Such is the abstract of the '*Histoire Comique des Estats et Empire de la Lune*,' a work which, like all those of which the satire is in any degree temporary, has lost a good deal of its first relish. It is, however, still worthy

* This is probably intended as a satire on a passage in Charron's work 'Sur la Sagesse':—"Hélas! on choisit les tenebres, on se cache, on ne se livre qu'à la derobée au plaisir de produire son semblable; au lieu qu'on le detruit en plein jour, en sonnant la trompette, en remplissant l'air de fanfares! Il n'est pas honnête de s'entretenir de certaines choses tandis qu'on parle avec orgueil d'un sabre et d'une pique; et ce qui sert à tuer l'homme est une marque de noblesse—on dore, on enrichit une epée, on s'en pare."

of perusal, especially by those who are acquainted with the philosophical history of the period in which it was composed: and the interest which it excites must, to an English reader, be increased by its having served in many respects as a prototype to the most popular production of a writer so celebrated as Swift. Nor has it only directed the plan of the Dean of St. Patrick's work; since even in the summary of the Lunar Voyage that has been presented, many points of resemblance will at once be discerned to the journey to Brobdignag. Gulliver is beset, at his first landing on that strange country, by a number of the inhabitants, who are of similar dimensions with the people of the moon, and who are astonished at his diminutive stature—he is exhibited as a sight at one of the principal towns—he amuses the spectators with various mountebank tricks—and acquires an imperfect knowledge of the language—afterwards he is carried to court, where he is introduced to the queen's favourite dwarf, and where great disputes arise concerning the species to which he belongs, among the chief scholars, whose speculations are ridiculed in a manner extremely similar to the reasonings of the lunar sages. The general turn of wit and humour is besides the same, and seems to be of a description almost peculiar to these two writers. The Frenchman, indeed, wanted the advantages of learning and education possessed by his successor, and hence his imagination was, perhaps, less guarded and correct; in many respects, however, it is more agreeably extravagant, and his aerial excursion is free from what is universally known to be the chief objection to the satire contained in the four voyages of Gulliver.

As Cyrano's 'Journey to the Moon' is the origin of Swift's 'Brobdignag,' so the 'Histoire des Estats du Soleil' seems to have suggested the plan of the 'Voyage to Laputa.' This second expedition of Cyrano is much inferior in merit to his former one, but, like the third excursion of Gulliver, is in a great measure intended to expose the vain pursuits of schemers and projectors in learning and science.

From an imitation, probably of the works of Bergerac, many of the 'Voyages Imaginaires,' which appeared in France during the first half of the 18th century, described excursions through the heavenly bodies. 'Les Voyages de Milord Ceton,' by Marie Anne de Roumier, is the account of an English nobleman, who, during the disturbances of his own country in the time of Cromwell, is metamorphosed into a fly, and in that shape is carried by a friendly genius through the moon and seven planets. The author accommodates the character of the inhabitants of each star to the name it bears on earth. Venus is the centre of amatory indulgence, and Mercury the abode of avarice and fraud. By this means there is conveyed a general satire on different vices; and a ridicule of individuals addicted to the predominant passion in the planet seems also to have been occasionally intended.

Bishop Wilkins could not escape, for a cynic in 1796 thus writes, in reference to his 'Discovery of a New World:'—

All hail to Cestria and her mitred Lord,
And may Pierian strains for aye record
That lawned Endymion of a happier age,
Who, wild with rapture and empyric rage,
On bold aspiring pinion could presume
To journey thro' the vast ethereal gloom;
Who, tired of earth and dreams of gowned rest,
Sunk in the Elysium of his Cynthia's breast.

Schiller gives us 'Pegasus in Harness,' which has been translated by Sir Edward Bulwer Lytton as follows:—

At Smithfield once, as I've been told,
Or some such place where beasts are sold,
A bard, whose bones from flesh were all free,
Put up for sale the muse's palfrey.
The Hippogriff, majestic, neigh'd,
And pranced as if in proud parade.
The crowd grew large, the crowd grew larger:
"In truth," they cried, "a splendid charger!
'Twould suit some coach of state!—the king's!
But, bless my soul, what frightful wings!
No doubt the breed is mighty rare—
But who would coach it through the air?
Who'd trust his neck to such a flyer?"—
In short, the bard could find no buyer.

At last a farmer plucked up mettle:
"Let's see if we the thing can settle.
Those useless wings my man may lop,
Or tie down tight—I like a crop!
'T might draw my cart, if kept in bounds;
Come, Friend, I'll venture twenty pounds!"
The hungry bard with joy consented,
And Hodge bears off his prize, contented.
The noble beast is in the cart;
Hodge cries, "Gee hup!" and off they start.
He scarcely feels the load behind,
Skirrs, scours, and scampers like the wind.
The wings begin for heaven to itch,—
And now the cart is in the ditch!

Up soar'd the machine,
With its yellow and green;
But still the pale face of the Creature was seen,
Who cried from the car
"*Dam in yooman bi gar!*"
That is,—"What a sad set of villains you are!"

Howbeit, at some height,
He threw down quite a flight
Of Almanacks, wishing to set us all right—
And, thanks to the boon,
We shall see very soon
If Murphy knows most, or the Man in the Moon!

### THE NASSAU BALLOON.

Keeping in mind the leading pastimes of "the people" at this season, we seize the opportunity of saying a few words about the balloon trip from Cremorne Gardens a week or two ago.

The popularity of balloons is something curious. It comes by fits and starts, like a stage cascade, or an English sunshine, or an outcry for the legitimate drama, or an exhibition of good pictures, or an overflow of dwarfs, and nigger vocalists, and immense animals. And an aeronaut is a species of perennial grub. In the winter we hear nothing of him: he hybernates with his balloon, in the chrysalis state, without doubt, of dressing-gown and slippers; but no sooner does the fine weather arrive, than he casts his skin, unfolds his wings, and is once more a creature of the air, until he "shrinks from the breath of the first autumn day." And then he disappears as mysteriously as the flies, or the pins; which we hold to be the greatest instances of spontaneous evaporation known.

Whilst all sorts of progresses and voyages, by sea and by land, have received every attention from our artists, we must confess that those in the air have been much neglected, as to illustrations. They have been principally confined to a large street woodcut, of a car filled with distinguished ladies and gentlemen, with no end of fireworks behind them; and an individual in the centre, supposed to be Mr. Green, politely bowing to the spectators, who, in kit-cat proportions, are waving their hats and umbrellas, and shaking their handkerchiefs, and giving way to all kinds of frantic enthusiasm. To supply this void, we despatched two artists to the scene of the last balloon ascent: one was to go in the car, and the other to remain on the ground. Some interesting sketches were the result. The first is entitled, "View of the company at Cremorne at the moment of ascent," and gives a lively image of the crowd in the grounds, in the midst of whom might have been seen Ibrahim Pacha, had the mob not hustled him up so that he could not be made out. This was the only illustration which our aerial artist favoured us with, as he got so frightened, and so completely in the clouds, that his art failed him. Our mundane draughtsman was more lucky. He first sends us a view of the balloon as it appeared from Waterloo Bridge, amidst the cheers of the boys, who directly started off after it, as vaguely as they would have done after a fire-engine, which is ever a reckless pursuit, whose termination may not be guessed between Gray's Inn Lane and Epping Forest. We ourselves were fortunate in taking a sketch of the balloon as it passed over our attic skylight, whilst we were pumping our brains for a subject. The following came by the inspiration of the moment:—

### SONG.

### THE AERIAL GREEN.

Air—*The Ivy Green.*

OH! a daring man is the Aërial Green,
As he rises above the wall
Of the turfy Cremorne, or for nothing is seen
From the road beside old Vauxhall!
How bleak soe'er the wind may feel,
Or dark the night may keep,
He lights the match of his firework wheel,
Though all below may sleep.
Creeping where nobody else has been,
A daring man is the Aërial Green!

Since Green first began his airy career,
How many his rivals have been,
But none like himself through the heavens can steer,
He's so knowing, although he is Green.
For Henson shall go, and be dimmed his fame,
And forgotten his Aërial Ship,
But Green shall still carry out his name,
And flourish in every trip.
Creeping up to realms unseen,
A daring man is the Aërial Green!

Our artist took his next illustration—a very graphic one—from the balloon as it appeared disappearing. There is much to praise in his spirited sketch. The treatment is simple, but very expressive; the balloon is

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c.Director.*

1864

evidently a point, and the drawing is free and unstudied. His next sketch is of the balloon when it was out of sight; and a similar one was sent us by our aerial artist—who recovered his presence of mind a little—of the view from the balloon after nightfall.

We must for the present conclude our paper; but an amateur who was amongst the voyagers has promised us his portfolio, to which we may possibly recur, and present the series of illustrations complete.

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I much regret that I have not been able to find the name of the author of the amusing paper entitled

CROTCHETS IN THE AIR.

MY DEAR TOM, Planet Earth, 29th September, 1838.

I have purposely postponed a reply to your impatient letter of the 16th instant. I am grateful to you for your kind anxieties upon my account, as evinced by your—"P.S. Pray answer this *without the delay of a* SINGLE MOMENT." (I give you your own emphatic markings.) Now, suppose—do but suppose—I had complied with your request, and answered your letter immediately upon its arrival, which occurred within only a couple of days after my return to this pen-ink-and-paper earth of ours—why, I doubt whether you could have understood one sentence in twenty of all I might have written to you; so inflated, so exalted was I, that my style must necessarily have been affected by my own feelings. You are aware of my detestation of that barbarous jargon which is compounded of Gallicisms, and Latinisms, and Italianisms, and all manner of *isms* (with the single exception of good-English-isms), and which is nick-named the modern fashionable style of writing: from all such *isms* my disgust of them would have kept me clear; but how could I have avoided the perpetration of a few balloonicisms? The moment I had "pulled the liberating-iron of my sensations," I should inevitably have "thrown out every bag of the ballast of judgment," and abandoned myself without opposition to "the buoyant gas of enthusiasm." How should you have liked that? Only two pages of it?—one?—only half a page? No, no Tom; rely upon it 'tis better as it is.

You ask me many questions. The first in order I will answer first, for the reason that it is the first.

"Did you go up in a balloon on Friday, the fourteenth?" I may reply to you in the words of Hamlet, I have been "nearer to heaven than when I saw you last, by the altitude of a chopine." But the next time you speak of that particular travelling carriage (the Great Nassau), pray speak of it with becoming respect, and call it *the* balloon. All others, whether beneath the clouds, within or above them, are mere balloon-sprouts, chick-balloons, balloon-*ettes*, in short. As is a peach to a pumpkin, so is the biggest of those to the Great Nassau. You sit in a thing like a sauce-boat, and look up to a world floating above your head. Methinks I hear you say—"Hold, there! Let off a little of your gas." I will; but not much, Tom. And now, having replied to your first question, I will, for the present, float over—(I beg your pardon, but I could not help *that*)—I will pass over all the intermediate ones, and notice your last. For this irregularity I have two motives: first, to get rid of a perplexing inquiry; and secondly, to let you understand at once the kind of account of a balloon-trip you must expect from me:—nothing about "Here the barometer fell to —," "Here the thermometer rose to —," "Here the mercury stood at —;" no balloon-jargon, but a plain, surface-of-earth description. So, on to your question.

"According to your observations, in what manner, and to what extent, are the interests of science likely to be advanced, and the state of society in general, *morally* and *physically* considered (dividing your answer to this portion of the question into two branches), likely to be improved by the use of balloons?—and within what probable period?"

This question is framed with such extraordinary precision, that, to one who could, there ought not to be the slightest difficulty in answering it. My observations, however, having been confined chiefly to the looking down on the chimney-tops, I am enabled to reply only, with anything approaching to certainty, first, that I do not know; secondly, that I cannot tell; and thirdly, that it is hard to say. Yet are there points upon which I will venture to speak positively. One (and, perhaps, the most important) result of an ascent in a balloon, is, in

a scientific point of view, that you may be quite sure of coming down again—somehow; the second, affecting the man morally, is, that it must, in a greater or a less degree, *elevate* his mind—for the time being; the third affects the man physically, and is, that unless he order the clouds to be well aired for his reception, he is very likely to get a touch of rheumatism (as I have done) from being wrapped up in a damp one. For any much more positive and useful information you may require, I beg leave to refer you to aeronauts of greater experience, and (to use a phrase more popular than polite) —— I wish you may get it. I now turn to some other of your questions.

"Why did you go?"

I might put off this inquiry by pleading the laudable ambition of rising in the world, but that I abhor a pun. Curiosity, then, was the leading motive, though not the only one. I wanted to go out of town; and this *was* going out of town, or the deuce is in it. Then, the novel mode of travelling! Be assured there is nothing like it *on earth*. One gets tired of being suffocated in coaches, choked with coal-dust in steamboats, rattled and rumbled on railroads. But, up yonder, the ineffable stillness, the progressing movement without the slightest sensation of motion! whether up, down, forward, back, you seem to be suspended motionless in the air, whilst everything above, below, and around, is complaisantly taking the trouble of moving out of your way. The slight, though perceptible jerk you experience at each stroke of the oars in a Thames wherry at Twickenham, is an electric shock compared with what (if I may so express it) you do *not* feel in a balloon. This is scarcely an exaggeration. As for Mac Adam—I now consider him but a bungler at the best. By the by, Tom, I wish those pavers, and unpavers, and repavers of Oxford-street, would leave their eternal wrangling, and just step up stairs for a lesson.

Then, again, another amongst my motives was a yearning after variety. It is idle to talk about going out of town for the sake of *change*, Tom. We quit London and go to Brighton, or Cheltenham, or Paris, or Vienna, or Constantinople. Houses, houses, houses! We weary of the ruralities of Wiltshire, and try Wales; tired of Wales, we fly to Savoy, or to Switzerland: it is the same thing. Trees, rivers, and fields; fields, trees, and rivers! with here and there a hill some certain number of feet higher or lower than another! Then, everywhere, in all places, people, people, people! And this, forsooth, we call a change! You remember poor Charles ——, who when tired, not absolutely of people, but of the every-day countenances he was in the habit of meeting about town, went to Thebes in the hope of seeing a variety in the "human face divine." Almost the first man he encountered was his linendraper, who was employed in taking the length of a fallen column with a yard measure. And what was his reason for being *there?* Change. Margate, he said, had become vulgar, and—which was worse—Ramsgate was trying to be genteel. No; believe me, Tom, that, for a positive change, there is nothing for it but, instead of going *down* into the country, to go *up* out of town. Once above the clouds, adieu to houses, trees, fields, rivers, hills, and people. There might you be for a month with millions of chances to one against your balloon being jostled by another gentleman's. And such independent travelling too! As our witty friend B——, who made an ascent some weeks ago, truly said, "No turnpikes to pay there." He might have added, no "What's the number?" no "That 'ere ticket don't clear this here gate;" for positively, Tom, there are no gates to clear. The boundless regions of air are open to you; not an acre is enclosed; and for ever might you float there, unimpeded by a humane caution to beware of spring guns, or a friendly hint about prosecution for trespass, and the amiable rigours of the law. Then again, you escape the three main annoyances to which you are subjected in *foreign* travelling elsewhere: passports are not required—nobody is there to ask who you are, where you come from, or what you may please to want in the clouds. There is no busy, prying, spying police to watch your movements, so that, were you dishonestly inclined, you might pocket a handful of little stars for brooches and breast-pins, if you could but reach them; though let us hope no aerial traveller will ever compromise the character of the natives of the earth by so shabby an attempt. And, last of this category, there are no Custom-house officers to search your car, and ask, "What have you got in that bottle?" But, let me tell you, there is one set-off against these comforts: there are no inns in the whole of that country; so that when what we had "got in that bottle," which was some sherry, was exhausted in drinking to the health of our dear little Queen, we could not get our bottle replenished for love or money. So you see, Tom, things are not absolutely perfect even there.

And then, the noiselessness, the perfect quiet, which I have before alluded to! It is the sublime of stillness. They who have not heard it—do not add this expression to your collection of bulls—they who have not heard it (for the ear is affected by it) can form no idea of it. In the stillest night, on the quietest spot on

earth, some sound is occasionally heard, how soft or slight soever it be—the ripple of water, the buzzing of an insect, the fall of a leaf. But up there, you might fancy yourself living in an age antecedent to the creation of sound. There might you indulge to the uttermost in the luxury of thought, reflection, meditation; there revel in all the delights of imagination, with not the ruffling of a butterfly's wing to put your fancies to flight. And, then, for a certain society of architects of which you and I are members!—O Tom! such a place for building castles in the air!

Another of your questions (for I do not take them *seriatim*), is, "How high did you go?"

Balloonically speaking, not *very* high. We did not go high enough to hear the music of the spheres; or to have made out what sort of looking fellow was the man in the moon, even had that chaste lady condescended to make herself visible. Indeed, the old ballooners, who formed five of our party of nine—that is to say, our admirable navigator Mr. Green, his lady, Mr. Spencer, and two of the Messrs. Hughes—those old ballooners, I say, declared we went no height at all; and, in fact, our greatest elevation did not much exceed four thousand feet (three-quarters of a mile), or, to make this vague statement somewhat more intelligible, only about twelve times the height of St. Paul's, measuring to the top of the cross. It was just high enough, however, for a tumble to have made us, the inexperienced in aeronautics, feel rather uncomfortable—and, perhaps, even the old ballooners themselves. Moreover, unlike a party which made a trip a few weeks ago, we had not taken the precaution of carrying up either a surgeon or a coroner in our company. But with GREEN for your guide (who is now nearly in the two hundred and seventieth ascent of his balloonical age), as reasonably almost might you apprehend the accident of being driven up to the clouds in a Paddington omnibus, as that he should let you down from them with inconvenient velocity.

I next come to your "three single" questions all "rolled into one."

"At what time did you go up from Vauxhall Gardens? how long did you remain up? and at what time did you come down again?"

I do not despise you for talking about a balloon going up, for it is an error which you share in common with some millions of our fellow-creatures; and I, in the days of my ignorance, thought with the rest of you. I know better now, Tom. The fact is, we did not *go up* at all; but at about five minutes past six, on the evening of Friday, the 14th of September, 1838—(you want "particulars," so there they are for you)—at about that time, Vauxhall Gardens, with all the people in them, *went down!* Tom—Tom—I cannot have been deceived. I speak from the evidence of my senses, founded upon repetition of the fact. Upon each of the three or four experimental trials of the powers of the balloon to enable the people to glide away from us with safety to themselves, down they all went about thirty feet; then, up they came again, and so on. There we sat quietly all the while in our wicker buck-basket, utterly unconscious of motion; till, at length, Mr. Green snapping a little iron, and thus letting loose the rope by which the earth was suspended to us—like Atropos cutting the connexion between us with a pair of shears—down it went with everything on it; and your poor, paltry, little Dutch toy of a town (your great Metropolis, as you insolently call it), having been placed on casters for the occasion—I am satisfied of *that*—was gently rolled away from under us.

At once to satisfy you upon the two other points of your triple (and pardon me for adding, your most unscientifically framed) question, *you* remained *down* during a little more than three hours; when, at about a quarter past nine, our able conductor, with an undeniable grappling-iron—an implement not made to take "No" for an answer—caught hold of the earth by the nape of its neck, as it were, on Wanstead Flats, and hauled it up to us with perfect ease. Four of our party, including Mrs. Green, stepped out of the cradle and returned to town. And here, on a dark night, on a lone heath—lone, do I say? No, by Jupiter! it was anything but lonely.

Wasn't it the first Lord Thurlow who longed for a day's shooting in an English mob? This may seem an odd, out-of-place question; but it shall presently be accounted for, and, I trust, to your satisfaction. But, now, to another of your inquiries.

"Did you, when you were tolerably high, experience any extraordinary sensations?"

None whatever, Tom, but of admiration and delight. I apprehend that, judging from the common consequence of looking down from a point considerably elevated, you expect to be told that the sensation of dizziness was amongst the number. I remember meeting the younger B——, the surgeon, just after he had assisted at the opening of Porson's skull. "Did you find anything extraordinary in it?" inquired I.—

"I guess what you expect," replied he, laughingly: "We found a little water, *but no Greek.*" Now, you are expecting to be told

How fearful
And dizzy 'tis, to cast one's eyes so low!

Not so, however, from a balloon at *any* height. I do not know the exact elevation of the Shakspeare cliff: I believe though, it is not, by a great deal, so high as the cross of St. Paul's. I have lain down on the verge of it (the cliff, please to understand me) and looked over into the sea; but have been compelled to withdraw by an overpowering sensation of giddiness. It has been the same thing when looking over from the top of that place in the Regent's Park (stupidly misnamed the Colosseum) which is considerably lower. Nay, within three days after our *ascent*—(I will, through the remainder of this epistle, humour you in your delusion, Tom)—I was at a friend's chambers *which are only on a second floor;* and, looking down from an open window into the garden (the sill of the window being rather low) I became giddy, and was obliged to retire from it! At an elevation of twenty-seven hundred feet, I looked down upon St. Paul's—that is to say, from about eight times its own height—layers of smoke, like thin clouds, hanging just above the swell of the dome, and not the slightest inconvenience of the kind you expect did I, or any of my travelling companions, suffer from our exalted position! This is a curious fact; but a fact it is which, I doubt not, will be corroborated by every person who has made trial of it.

Now, how is this extraordinary circumstance to be accounted for? I have heard it explained thus:—In a balloon you are entirely detached from the earth: there are no intermediate points by which the eye can be *gradually* conducted downwards; so that the impression of height upon the senses, that impression which causes dizziness, is indefinite, vague. From the parapet of a house, or from a column, or a tall cliff, the eye, on the contrary, is led by an intervening medium down to the base, and the elevation upon which you are placed being thus rendered palpable, dizziness (to such, I mean, as are liable to that affection) ensues. Amongst the many circumstances accumulated by Shakspeare to convey a terrifying notion of the height of the cliff at Dover, which is the one by which he mainly achieves his purpose? It is not, I humbly conceive, by

The fishermen that walk upon the beach,

and who

Appear like mice;

nor by

The tall anchoring bark diminished to her cock:

it is not, indeed, by any of the objects which he describes as seen in the extreme distance below. It is, I think, by the

*Halfway down*
Hangs one that gathers samphire: dreadful trade!
Methinks he seems no bigger than his head.

Setting aside the frightful picture of danger so powerfully *painted*, one may say, by the words "*hangs* one," and "*dreadful* trade," as having nothing to do with the present question; that giddy and fearful "half way down" it is which, more than all the rest, impresses the imagination; and which, *as a means of comparison*, enables, or, rather forces the mind to conceive the awful whole of the precipice. Now from a balloon there is no "halfway down:" it is all (don't say *neck*) or nothing; and from our aerial omnibus, when over the river, we looked down upon "the tall anchoring barks" (which appeared no larger than Thames wherries) with an eye as steady as theirs on board who might have been looking up at us.

Now do not from this, Tom, take it into your head that I am about to open shop as a philosopher, and turn dealer in causes and effects: no such thing: the theory I offer you, right or wrong, good or bad, is none of my own; but as it is the best I have been able to procure, I generously beg your acceptance of it.

A timely visit! At this moment, L-chf—d (no mean Shakspearian, and who has the poet's expounders and confounders at his finger ends) is with me. He reminds me that Johnson, in a note upon the passage which I have quoted, expresses an opinion at variance with the theory I offer you. Were the theory my own I would defend it against him were he twenty Johnsons; as it is, I leave to its rightful owner the trouble of its defence. For my own part I think the doctor in the wrong, and, if I chose, could set him down within the compass of two commas, one semicolon, and a full stop. What was Johnson, indeed! He wrote the lives of some poets; a tolerable

preface or two; a few passable essays; compiled, or composed, a dictionary; but was he ever up in a balloon? If he were, Boswell is culpably silent upon a point of such overwhelming importance. Time was, I entertained a slight respect for the leviathan of literature, as he was wont to be called; but since I have taken to read the lucubrations of Mr. Fee'dwell, the leading criticling of the 'Penny Dictator'—for, now-a-days, literature and science, in all their respective branches, are made up and sold in packets price only one penny each—since then, I have learnt to treat the blustering booby with becoming contempt. As for Pope—pooh! for Addison—psha! for Swift—pish! and all the Queen-Anne's-men tied together in a bunch—a fico for them! They were tame, twaddling, and understandable; "pretty fellows in their day" but compared with the geniuses of our own, the high-soaring, deep-searching, soul-dissecting, heart-piercing pets of the criticlings———! Draw what conclusion you may please from the comparison, my faith in my 'Penny Dictator' and his pets is unalterable. "I stand by my order;" and

Nul n'aura de l'esprit hors nous et nos amis.

So now to proceed.

"Where did you go?"

Where!—Set up your balloon, Tom: For ease and rapidity, there is no travelling like it. A balloon has performed a mile in a minute for miles together! Only think of the conveniences and delights of that! You are sipping your wine at Windsor; a sudden fancy seizes you to go to the Opera; you order your balloon to be brought to your door at half-past seven; off you go, and before the clock strikes eight, there you are comfortably *installed* in time for the first bar of the overture! What a luxury! But suppose that, at the end of the half hour, you peep through your netting, and, instead of finding yourself just over the Haymarket, you discover that you are five-and-twenty miles on the way to Oxford, or Southampton, or Bristol? "*Where* did you go?" indeed! We went wherever our carriage, and its sworn confederate, the wind, chose to transport us. I admit that that most experienced, best, and safest balloon-driver in the world, the "Great Captain of the Air," Mr. Green, has complete control over the "Here we go up, up, up, and there we go down, down, down;" but I believe it is not within the power of human ingenuity either to restrain or oppose the horizontal inclinations of the confederates, so as to command the "whereabout" with anything approaching to certainty, or precision—if at all. So much for one of the practical uses of the *science* of ballooning. This ought, perhaps, to have formed part of the answer to your concluding question, and which I have taken as the second—but it matters little.

Now, then, once more for the "*where?*" The balloon, which rose heavily—Now, don't be impatient, or angry, Tom; you shall have your answer in a minute or so: but if one may not digress in a familiar letter to a friend, where the deuce else is digression allowable?

I have been told that the wicked wag of one of the Sunday newspapers said, the reason of that was, that a certain friend of yours, who was in the car, had got one of his heavy manuscripts in his pocket; but that that being thrown over, the machine went up rapidly. Pleasant, this, for a professor of *light* literature, eh, Tom? Never mind; hard as it is, one must, as the sailors say, "grin and bear it." I wonder how poor Thomas Warton endured it, who received the joke direct at his head, which it was made expressly to fit—(*Vide* Probationary Odes)—when the joke was bran new, upwards of fifty years ago. Considering the terrible effects of it now, at twentieth-hand, the consequences to him, poor fellow! must have been awful!

Once more, then, to—"Where did you go?"

The balloon, which rose heavily, being lightened of a bag of ballast—not bag and all, Tom, or mercy upon the most matter-of-fact skull to be found in all the Realms of Dulness that might have chanced to come in its way—not excepting even the cast-iron sconce of a *critic* (*?!*) in a certain Dublin print, who, in his notice of a professed satire upon the *would-be* nautical novels of the day, and which is, for the purpose, an uninterrupted series of intentional blunders; he, poor innocence! taking the whole in sober seriousness, gravely complains that the writer of the satire knows no more about life at sea than a Highlander knows of knee-buckles! And here be some of your leaders of public opinion, eh, Tom?—But, as I was saying, the balloon being lightened of a bag of ballast, it became a little more nimble, and, from the direction it was taking, seemed inclined to start for a race with the Birmingham train. Presently, however, it changed its mind and took a different course. *Mind* did I say? no, no; it has no mind. The truth must be told. It is a senseless, swaggering, inflated creature, which makes a figure in the world, but is supported by nothing intrinsically valuable:—gas, nought but gas. It can do little or nothing for itself; it is dependent for its ups and downs upon the will or the caprice of others. It cannot get on, it cannot get forward, it cannot move an inch if left to its own merits; but *raise the wind* for it, and it will

rise and rise till, to the ken of mortal eye, it appears no bigger than a pea: exactly as it is with some poor, puffed-up, human thing whose real insignificance is not discovered till it is raised to an eminence which it is unqualified to maintain. And thus, Tom, something not unuseful, if properly considered, may be learnt even up in "the desert air."

But, methinks, I hear you exclaim, "But what has all this to do with my never-to-be-answered question,' Where did you go?'"

Well, then; we went—Why, bless my soul! now I think of it, I told you an hour ago: we went all the way to Wanstead, the name of the precise spot where we descended being——. Now, I cannot for the life of me help it; for when I sit down to scribble a letter to a friend, the first thing that occurs to me, so it be at all to the purpose, must *out*. You are a collector of odd coincidences: here is a brace for you. Benson Hill (who can very well afford to spare a pleasant anecdote), travelling through I forget what county, upon coming to a sharp declivity which opened to his view a beautiful prospect, hallooed to the post-boy to tell him the name of the place: "Benson Hill, sir," said the boy. That's one. The other night, after bobbing in and out of wet clouds for more than an hour of our time, we came down in the dark, on a damp, cold, comfortless heath. Upon touching ground, we heard shouted by a hundred voices, "Wanstead *Flats!* Wanstead *Flats!*"—the latter word being annoyingly well articulated. There's the other. But, for a gratifying compliment—! Yesterday, I met your sister Clara.—"So!" said she, "you have been up in a balloon?"—"Yes," replied I, in the tone and manner of one who thinks he has performed a marvellous exploit, and is prepared for a complimentary remark upon it.—"How *could* you be such a FOOL!" exclaimed she. And that, Tom, I swear it by the Great Nassau! was all I took by my motion.

Now, again, to your letter; and I promise you I will no more digress—unless the temptation should prove an overmatch for my resolution.

"What did you see?" comes next.

Sights, oh! such sights! Gulliver not fabulous. Men and women six inches tall; and in proportion as we rose, they diminished—to five, four, three inches. I am glad I am down again, for I was imbibing a very contemptuous opinion of my species. I apprehend, however, this feeling is not peculiar to balloonists, but that it is common to very many who are placed but a little above their fellow-creatures: the height of a mere carriage-wheel will sometimes produce it. Strange! From an elevation of not more than four thousand feet we could not distinguish who composed the swarms of moving mites beneath us. There were amongst them—and this is no wild assumption—peers of the realm, famous warriors, profound philosophers, fine poets, patriot orators whose voices are never raised but for their country's good—(count *them* upon your fingers)—orator-patriots who profess to be regardless of their own—(take Babbage's machine:)—there were the proud, the humble, the dignified, the lowly, yet, to us, the greatest amongst them was undistinguishable from the rest! Again I exclaim, Strange! But if from our paltry elevation, borne upwards and upwards on the wings of thought, till, wearied with the unbounded and interminable flight, we pause to reflect that from height unimaginable those living atoms are beheld ——. "And thereby hangs a tale," says Touchstone.

Go up in a balloon, Tom; when you come down again reflect upon what you have seen; but, chiefly, re-cogitate the thoughts which the novelty of the situation cannot fail to suggest to any but a mind of mud: and if you find yourself a harsher philosopher or a worse man than you went up—why, then, I shall only say you will not have deserved, as you will not have profited by, your ride in the region of birds.

Sights! There was all London at a grasp, made of baby-houses, and pepper-casters, and extinguishers, and chess-men, with, here and there, a dish-cover—things which you call domes, and spires, and steeples. Oh, the vanity of man! Then there were its squares and pleasant places, bedecked with gooseberry-bushes intersected by yellow strips, half a yard wide, in curves and zigzags. Then there was the "broad bosom of old Father Thames." Broad! I looked down upon it at its broadest, excluding with my half-closed hand all other objects, and thought what a blockhead must be the architect of Waterloo Bridge to have built nine arches for it when one would have spanned it! Presently I looked at the bridge and wondered how the architect could be so stupid as to build so small a bridge for so wide a river. Had *I* been the architect, thought I, what a bridge you should have seen! It is astonishing, Tom, how wise we are, and how much better we understand things even than they do whose business it is to understand them, when we see them imperfectly at a distance! Since my return amongst you I have taken a nearer view of both bridge and river, and think the architect knows more about bridge-building than I gave him credit for. That reminded me that I have some few other trifling matters to reconsider in the same way—and perhaps, Tom, so have you.

We passed along the Blackfriars' Road (almost in a direct line), having hovered for a while over Bedlam. I wondered what the lunatics thought of the Bal-lunatics. Perhaps the most rational among them were of opinion that we ought to change places with the maddest of their companions.—At one end of the Blackfriars Road stood a bodkin bolt upright, with four little dots of light about it—they were just beginning to light the town—and at the further end were two other bodkins, commemorative of two great men. One could not but admire those two bodkins, they seemed so admirably adapted to their purpose.

We were now blown westward, and saw one of our Theatres Royal. It was hardly possible but to mistake it for a *minor theatre*. This again may have been the effect of distance, which, when near it, *or in it*, would doubtless be dispelled.

And what is that with its sloping, black-slated roof, that seems no bigger than a dog-kennel? Oh, melancholy object! it is a mausoleum, the last resting-place of so many departed *Fortunes!* Enter its awful portals and RUIN welcomes you as her guest! Yet such are the calenturian fascinations of the place—(forgive me for writing *fine*)—that no sooner is one hapless victim ingulfed in its fatal depths, than another and another and another rush eagerly to the brink, struggling against each other for the fearful precedence of destruction. It is, in plain English, *Le Théâtre de l'Opéra Italien*. Tom, I have an odd crotchet. I have long been trying to be ruined and have not yet succeeded. Now, the first time you see advertised to be lessee'd "that most desirable property," such or such a theatre—but let it be a large one, for I have no desire to be ruined by halves, that I promise you—engage it for me. I shall be prepared to stake the usual sum required upon the adventure, namely 00,000*l.*; nor would I haggle about an additional 0, or so. In consequence of my inexperience in management I may, the first season, be ruined for no more than three thousand, or four thousand pounds, and thereby be reduced to the necessity of taking nothing but a good house in town and *setting up* my cab. Next season I may have the misfortune to be ruined to the tune of five thousand or six, and thus be inhumanly compelled to add to my miseries a snug box in the country and a *calêche*. On the third and fourth seasons, ruin increasing to a degree intolerable, I shall be rudely driven out of my snug box and forced to take refuge in a handsome villa, with nothing to console me for the inconveniences and sufferings attendant upon my unhappy change of condition, but an additional equipage, a few more horses, and a ———. Tom, I *will* be ruined.

In yonder little building space is found for the repose of hundreds of illustrious men who have conferred glory upon their country, and hundreds more are therein commemorated. It is Westminster Abbey, wherein, as it is said, a monument to the memory of BYRON is *not* to be erected. Is there then no vacant nook remaining to receive it? I know what you will reply; but, after all, the question is a two-handled question, and (I willingly admit it) a delicate one. The right handle—I mean thereby merely the right-*handed* handle—is held by the Admissionists, the left by the Exclusionists. The cry of the latter is "Irreligion! Immorality!" of the former, "Place for him whose genius has added glory to the glory of the poetical reputation of England!" Heaven forbid that the last and most sacred tribute that a grateful country can pay to the memory of departed worth, should *ever* be desecrated by its indiscriminate bestowal upon doubtful religion or questionable morality! but ——. In short, Tom, I see but one satisfactory mode of settling the dispute: give us an *expurgated*, a *Family* edition of Westminster Abbey, in which not a name shall remain that may not stand as a type of absolute perfection; and *that*, by silencing the Admissionists, will at once put an end to the controversy. How the holiday-folks might like this arrangement is a matter of minor importance; but it is probable they would not see *quite* so many monuments for their money.

Then we saw the statue of George the Third, in Pall Mall East. Why do people abuse it so? I assure you it did not look so much amiss:—to be sure, we could see nothing of the pig-tail or the cocked hat—and, indeed, but very little of the rider.

And the National Gallery. I dare say, now, you fancy one feels a more than common contempt for it when viewing it from so great a height. If so, you never were more mistaken in your life: one's contempt for it is not in the slightest degree increased. Perhaps you will explain this circumstance by the reason that it has been *looked down upon* from the first.

And now we were carried back again to where the Albion mills are *not*; and thence, across the river, to the Tower, clearing St. Paul's in our flight.

A curious calculation was once made, having for its basis the relative sizes of the elephant and the flea: that, if an elephant were endued with the saltatory powers of its smaller fellow in the brute creation, it could leap from Hyde-Park corner to Greenwich Hospital at one bound, clearing St. Paul's by the way! The intent of this

calculation was, if I recollect rightly, to show that, *if* Nature had bestowed on the elephant a portion of the flea's facilities for locomotion, how much more serviceable an animal it might be made than it actually is. I have lately been reading a great deal of Philosophy, natural, moral, and political—principally the last—by which I have so far profited that my head is crammed full with IFS. To what extent the world would be improved were all those doubtful IFS converted into positive Is's, I will not venture even to imagine: nor will I presume to doubt that if Nature would adopt the hint of the Improver upon the construction of elephants, and, for the future, make those unwieldy animals more like fleas, vast advantages therefrom might accrue to society; but I have a crotchet, that *if* fleas were more like elephants—the consequences to society would be exceedingly disagreeable. Upon the whole, therefore, I am of opinion that *this* IF—*to say nothing of some few others*—had better be let alone.

St. Paul's! To be looking down upon that stupendous structure from many times its own height, produces a strange impression on the mind! I can describe or express it but in one way, and am even forced to coin a word for the occasion: it seems like *possibilifying* an impossibility. Beyond this, one's sensations are not definable: but I envy not the dolt—if such a one there be—who has accomplished this, or can at any time afterwards reflect upon having accomplished it, with indifference. Now should you tease me for a month I can say no more about it; but here—

[ ]

I leave a blank, which you are at liberty to get some one else to fill up upon the subject—if he can. And now, Tom, you are welcome to quiz my St. Paulserism, if you please.

I have candidly confessed to you that *Possibilifying* is a word of my own coining; *St. Paulserism* issues from the same illicit manufactory. Now, neither of these being current, I cannot compel you to take them; so, if you choose, you may nail them down as counterfeits upon the back of your Dictionary, and prevent their getting into circulation to the detriment of the lawful English of the realm. Tom; if all words of the same stamp put, and putting, forward, were to be treated in that manner, what a very ugly appearance our Johnsons would make! Why do poor devils sometimes coin base shillings and sixpences? It is because they *are* poor devils, destitute of real money. Why do certain writers interlard their pages with such chambermaid-*isms* as I have before alluded to? It is (for a corresponding reason) because ——. And that's another of my crotchets.

And here we are over the Tower. What would Julius Cæsar have said at seeing his White Tower, with its four turrets, converted into a stand of cruets! And here we saw some tiny red things placed all in a row: they moved first one way, then another; now they formed a line, now a square, and so forth. At the Pantheon Bazaar you may see exactly a like toy, which, by merely pulling a bit of string, is made to perform similar evolutions. I wonder whether it be an expensive toy—one of much value—for it is the toy by which, or strictly speaking, *with* which, national disputes are settled. This may appear very absurd; it is, nevertheless, true, and I'll tell you how the matter is managed, Tom. Suppose two great nations squabbling together as to which has the best right to a little bit of barren rock, lately thrown up by some convulsion of Nature, somewhere in the Pacific Ocean; which little bit of rock is of no use to either party, and to the possession of which neither has the smallest right in the world. Well; this being "a just quarrel upon the issue of which depends the very existence of this great nation," says one; and this being also a "just quarrel upon the issue of which depends the very existence of *this* great nation," says the other: instead of settling the dispute by a sincere appeal to reason, common sense, and the common principles of justice—for, mind you, they both, in the first instance, *make believe* to do so—instead of that, they set about knocking to pieces each other's toys, and the party whose toys, "by the aid of Divine Providence," hold out the longest, takes rightful possession of the little bit of rock, and enjoys the invaluable privilege of blowing a horn and shouting "Glorious Victory!" into the bargain. Now that is it exactly; and if ever you and I should have the misfortune to come to a dispute, we will each purchase one of those toys at the Pantheon Bazaar, and settle our misunderstanding in that very rational manner, Tom.

By the by, here we heard the tiny band play a small "God save the Queen," in sounds not quite as powerful as those of an Eolian harp; and—touching our "hearings,"—at seven o'clock we heard the hours struck by the repeaters in half the pepper-casters and extinguishers of London; such of them as were provided with musical snuff-boxes, chiming the quarters.

Just over the Jewel Office, one could not help thinking of poor Colonel Blood, of crown-stealing memory. Unlucky dog! there were no balloons in his days.

Looking down again, there are six little boxes, detached from each other, all of which might be placed in a

moderately-sized room. They are the warehouses belonging to the St. Katherine's Docks! And there are hundreds of "tall anchoring barks"—(of which, when immediately over them, you see neither their masts nor rigging, nothing but their white decks)—which appear no bigger than Thames wherries! Pretty little things! When ultra-liberalism shall have done its best for free trade, and for the all-against-*us* reciprocity system: when all the negroes shall have been *white-man*cipated: when Sambo shall be Emperor of Jamaica, Alcibiades King of Barbadoes, and Ptolemy Viceroy of Antigua; what appropriate, what commodious things those diminutive ships and warehouses will be for the purposes of our Colonies and Commerce! Don't sail away, little ships—you may ere long be wanted.

The want of appropriateness—of adaptation to a purpose—is a greater fault, and is more sensibly felt, in Architecture, perhaps, than in any other—— Stop! I will not inflict a dissertation upon you, but merely tell you what put this thought into my head: it was looking from those warehouses to the new Hall of the Goldsmiths' Company. Those—vast, massive, substantial, standing in the naked simplicity of brick and mortar: the Hall a palace, in which are united splendour and elegance; which is ornamented with all that the richest fancy, tempered by the finest taste, could suggest. Yet each, in its way, is an admirable example of appropriateness—of exact adaptation to its particular purpose. It is not a little extraordinary that two things so dissimilar should have emanated from the same mind, for both are the works of one architect: and it may be a erted that Hardwick has displayed as correct a taste in its piles of plain brick and mortar as in his gorgeous palace. Another instance of this quality is under one's eye at the same moment, the noble Post Office; and not far from it, another—Vulliamy's Law Institution in Chancery Lane, an edifice which for appropriateness, and for integrity of design, is not surpassed by any in London. Contrasts, no less than comparisons, are odious: I, therefore, will not say anything about the ——Wind! Wind! hold hard! Don't blow us back again to the National Gallery.

And that gloomy stone building is Newgate—a prison wherein are confined felons of different degrees in crime, from the petty pilferer to the deliberate assassin. Some are expiating their offences by a temporary loss of liberty, others awaiting their day of banishment, haply some the hour of death. By Draco! but this is intolerable! What right has man to inflict such sufferings upon his fellow-creatures? How should *you* like to be caged for three months in a disagreeable room in Newgate and prevented the exercise of *your* usual avocations? How would *you* endure the being torn from your family and friends and sent to a country not of your own choosing? With what stomach for your breakfast would *you* get out of your bed at eight in the morning to be strangled at nine, in the open face of day, and in the presence of thousands of persons collected together to glut their eyes with the sight of a human being throttled with a rope—for such is the fashionable phrase—you call it the *cant*—for describing the execution of a murderer: how, I say, would *you* like that? To this you will reply that you never cut a purse, ruined a family by forging a will, or murdered a man in his sleep, because he happened to have five pounds in his waistcoat pocket for which you had a pressing occasion. I repeat it: it is intolerable that any of our fellow-creatures should be treated in a manner which we ourselves should not relish. You are a kind-hearted fellow, Tom; you feel acutely for the *unmerited* sufferings of your fellow-creatures, and would to the utmost of your power relieve them: I will even go so far as to admit that you are not bloody-minded. But why will you persist in calling the new school of Humanity (of which I am an humble disciple) the "Humanity-run-mad?" We require nothing more than that *there shall be no sort of punishment for any sort of crime:* and when through the exertions of the popular member for Dyot Street (who is to be) this principle shall have become the law of the land, then shall Newgate and the Millbank Penitentiary be converted into sets of pleasant and commodious chambers for the retirement of thieves, forgers, and murderers, till the "affair," in their respective cases, has had time to "blow over."

On the opposite side of the river we saw a line of arches, nearly as large as those of a bagatelle-table, extending to the length of about three miles; and on it were several little trunks, seemingly running away with each other: it was the Greenwich railroad, with its train in progress—the prettiest plaything imaginable. I wonder what is to become of all the horses! Day by day is their utility diminishing. Some time ago, Mr. John Bull, who sometimes cries out before he is hurt, was in a prodigious pucker at the bare idea of England selling to France, Russia, and America, some of her finest race-horses. Why not sell the whole of them, every beast that runs, draws, or carries, donkeys and all, and make railroads and steam-carriages for the money? It would bring those insolent quadrupeds to their senses, and teach them that we can do without them. As for horse-racing, that, even as things are, is said to be getting a little *out*, for reasons, if for any, which they may know who are more in the secret than I would pretend to be. Yet racing might still go on: we could have steam-carriage races. Then

would there be Lord A.'s celebrated Smoke-jack beating Colonel B.'s famous Steam-away by the length of half a boiler; or it might be a boiler-and-boiler run for the whole distance; or Smoke-jack might win easy by three carriages. But this style of racing would be liable to one serious evil: suppose some jockey—or some gentleman—were to play tricks with a rival's boiler—or his own—by clandestinely loosening a screw or so? Now we know very well that, with live animals for racing, *no trick ever is, or ever can be played.*

I have a crotchet, though, that should this railroad and steam mania continue much longer, a balloon in the air will be the only safe thing to live in. Like Belvidera, the cry with everybody is, "I'll dig, dig, dig;" and we shall go on digging and digging till, one of these fine days, we shall have the upper crust of the earth breaking in. There'll be a catastrophe for you! You think I am jesting? Not a bit of it: I have seldom been more serious upon a grave subject since I first set foot upon this half-scooped-out globe of ours. Conceive, if you can, the quantity of iron already taken, and daily taking, out to make posts of, and columns, and fences, and soft stuffing for chairs and for mattresses, and railways, and bridges, and steamboats, and cannon and shot, and thousands of other things conducive to the pleasure and benefit of mankind! Then the millions on millions of bushels of coals! Gilbert Gurney's friend, Hull himself, might cry "bushels" here! Why, one-third of the world's solid inside has already been dug out, and let off in smoke.

> Thus far into the bowels of the land,
> Have we march'd on, without impediment;

but things can't go on in this way for ever, Tom; and the end of it will be as I have predicted.

Then, as if the crisis were not being brought on with sufficient rapidity by great means, it must be assisted by small! There are your ante-diluvian-deluge people, the geologists—there they go about chipping and chipping! they don't do much, certainly (I mean *in the way of mischief*), but every little helps. Talking of Geology, how nearly she has put poor Botany's nose out of joint! Every man, woman, and child you meet have hammers and chisels in their pockets. But by Botany, I mean that science, or rather that part of the science, which teaches young ladies to call some of the prettiest things in Nature by some of the ugliest of names, to say the best of them. By Geology, however, they are taught to use such words only as *quartz* and *silica*, and the like, from which they cannot derive an idea; so that, in that respect she is, perhaps, a safer instructress for them than her less civil-spoken sister.

Names! How oddly one thought leads on to another! How would you name the present age? The Iron Age, but that it lacks novelty. The Age of Smoke—or of Steam? No,—the Age of Vapour would be better, for not only are most things kept going by vapour, but also many men. They begin in vapour, they go on vapouring, and in vapour they end. In common parlance, this is called "keeping up appearances." For instance: A banker is in a tottering condition: he starts a new carriage, multiplies his "grand dinners," and "princely entertainments" (as they are described by the newspapers), and common report adds a plum to his vast fortune. Matters become worse with him: he makes it known that he is treating for the purchase of a magnificent estate; he must now have turned a million: and the "house" is besieged by suitors for the favour of being allowed to place their money in the hands of that richest and safest of all existing bankers. Next morning, the "house" is again besieged—but the doors are closed as fast as bolts and bars can make them. Accounts are examined: they show that his vast fortune was from the beginning, and is now, 0,000,000*l.*; a dividend is declared of five-farthings in the pound, payable at the end of fifteen months, and the "suitors," thrusting their hands into their empty pockets, whisper to each other—"Vapour!" The next is a shopkeeper, who——. But one instance may stand for a thousand. An' you love me, Tom, let us call this the Age of Vapour.

It was now night—dark—and we had seen all the sights which daylight could show us. And where think you we are now? Up amongst the raw materials of which are made hail, rain, and snow—enveloped in the clouds. It was a fine situation for studying Meteorology, and you may be sure I did not miss the opportunity. I have nearly completed a Weather-Almanac which I will warrant to be *wrong* not more than nineteen times in every twenty: so you see I have given Murphy the go-by, and with something to spare.

It was a very nice, clean cloud, Mr. Green chose for us, perfectly white, but (as I believe I have already told you) rather damp. It was so beautifully white that a crotchet took me that it must be the very material of which angels' garments are made. If so, and one had to choose between a fleecy cloud and fleecy-hosiery, I should follow the counsel of my left elbow, which at this moment whispers me for which to decide. It would be an insult to that pure cloud to think of a London fog at the same time with it: even the cleaner and less

disreputable sea-fog must keep its distance. It was semi-opaque; above, beneath, and round about us; and, although it did not prevent our seeing each other with perfect distinctness, it seemed to be so tightly drawn round the netting that supported the car, that had one thrust his finger through the meshes I fancied he must have made a hole in it. Ha! ha! ha!—(That is how we *write* a laugh for the stage, Tom; and I have known actors so correct in their study, so scrupulous in the delivery of their text, that they would not give the audience a ha! more, or a ha! less than their author had furnished them with for the purpose. Care and attention in this respect are faults, however, which some actors I see are much less prone to commit than some I have seen. But lest you should imagine it is *this* I was laughing at,—no, no—I will give you the laugh in its right place.)—Ha! ha! ha! It certainly did seem very odd to be perched up there, like birds in a wire-cage with a white cambric handkerchief thrown over it, suspended from the ceiling, unconscious of the slightest motion, undisturbed by the slightest sound.

Well; after some time we descended a little, leaving our nebulous curtain above us.

But *London* showed another sight—!

Now I am aware that this is mal-treating a line of one of Campbell's finest odes, but it has itself mainly to thank for it: why did it thrust itself so obtrusively and temptingly in one's way? Moral, for some young gentlemen, and here and there for a young lady—which they may deduce for themselves.

It was indeed a sight—one which has rarely, very rarely, been seen by, or "within the memory of, even the oldest Balloonists." Mr. Green himself, in all his two hundred and seventy ascents, cannot number it more than (I think he said) four or five times. We certainly had been put upon short allowance of daylight for our observations, but here was a glorious compensation for that deficiency. *It was quite dark.* And now conceive yourself looking down on an enormous map of London, with its suburbs to the east, north, and south, as far as the eye could reach, DRAWN IN LINES OF FIRE! For anything beyond this I must leave you to your own powers of conceiving; for, to speak frankly, my powers of describing are here at a dead halt.

A few years ago it was calculated that in moral London there were nearly twice as many gin-shops as in reprobate Paris there were coffee-houses, and half as many vendors of physic as of gin. How the account of Parisian coffee-houses may stand now, I know not; but—mark the March of *Gin*-tellect!—to the disgrace of our country, and of our legislature also, who if it possess the power of checking or diminishing the evil yet neglects to do so, gin-shops—(with equal regard to the refined habits of our lower and lowest classes, and to the insidious allurements concealed under pretty and palliative names, now designated gin-*palaces*)—gin-shops have more than doubled their number! The increase of apothecaries'-shops (and they, too, are many of them nick-named "Medical Halls," "Pharmacopœian Emporiums," and so forth) seems to have maintained its fair proportion. With Gin *versus* Jenner (leaving Physic to an equal balance of kill and cure at the year's end) Malthus need not have been so violently alarmed about an overwhelming increase of population.

"And what put *that* into your head?" you will ask.

It was looking down upon those lines of fire and observing the great number of little brilliant spots of light, blue, green, purple, and crimson, with which they were variegated, each indicating a Temple of Æsculapius! Now I should not wonder at seeing, in the course of a month, that name in gilt letters over the door of some dirty little physic-shop in St. Giles's.

To tell you now of two or three pretty, merely *pretty* things we saw besides this, such as Greenwich by gas-light (though I don't like to throw away such a sweet alliteration) would be an anti-climax. The burning map, therefore, shall be the last scene of my pantomime. What a hint for *somebody!*

"The whole to conclude with,

And has been in preparation for many months,

A grand, novel, and truly unprecedented Exhibition,

TOTALLY REGARDLESS OF ALL EXPENSE, AND AT AN IMMENSE OUTLAY,

Resolved to gratify the public, and which only the ample means of this Establishment can produce,

A MAP OF LONDON,

Upon an unrivalled scale of magnificence, drawn from actual measurement by the first Artists

IN BURNING FIRE!!!"

So now, Tom, we'll prepare for our descent.

But our cautious coachman had taken prudential measures for this not very long after we had cleared the chimney-tops, spires, steeples, and such-like impediments. Hands were set to work—his own being sufficiently occupied by the important care of the valve-lines—first, to unfix and take in the purple covering which, with its yellow fringes and festoons, conceals the white-wicker nakedness of the car, and gives it so snug an appearance. This being done, and the covering folded up and placed in a bag at the bottom of the carriage, the next order was to let go the grapnel, which was soon dangling at the end of a line of a hundred, or a hundred-and-twenty feet in length. Then, the ballast being arranged so as to be conveniently "served at the shortest notice," we were ready to descend as soon as choice or necessity might require. And, when the final descent was determined upon, —"Now," inquired Mr. Green, "how much ballast have we got remaining?"—"Oh, plenty," replied some one.—"That answer won't do: *how much?*"—"Why, five or six bags under this seat and four or five under the other."—"That won't do: how many bags *exactly*, and what are their *weights?*" These questions having been satisfactorily answered, "Now, Mr. ——," continued Green, "be ready with a bag of ballast on *your* side, and you Mr. —— with one on *yours;* and when I call you by name—but be sure you wait till you hear your own name called!—please to throw out about four pounds of ballast."—I give you these particulars, trifling though they be, first, in justice to Mr. Green, who, you will thence gather, is not the man to neglect a chance of safety even of the value of a grain of sand; and next, as letting you behind the scenes, as it were—an indulgence but seldom accorded to the spectators of the public performance, the ascent.

It was not, however, till nearly two hours after these preliminary measures had been completed that the descent was accomplished. There was little or no wind, as you will infer from the fact that at the end of a three hours' ride we found ourselves no farther than Wanstead. For nearly half an hour, the balloon, having crossed a serpentine thing about six yards long and two inches broad (the River Lea) remained almost stationary over a lime-kiln, near the junction of the Romford and Chelmsford roads, quite high enough, though, to escape singeing. In vain did Mr. Green bob up and down, and up again, in the hope of meeting with a current that would carry us *some* where, the further the better; for a descent near London is never desirable (and the less so at night), as the balloon is generally followed by a numerous and mischievous rabble from the outskirts of the town. And so it happened with us. But up or down it was the same thing; there never was known a worse season for currents; so that, at each descent, there was the eternal lime-kiln beneath us, and no one seemed inclined to make *that* the landing-point. In vain, also, did our captain endeavour to elude the pursuit of the rabble (whose shouts we distinctly heard) by hiding himself in the clouds: no sooner did we reappear than again were we saluted with their "sweet voices." Well; we could not remain up for ever; so, a convenient spot for the purpose being discovered, there we alighted in safety and with perfect ease—not the slightest rebound intimating to us that we had touched ground. Should Government ever establish a line of balloon-packets, I hope Mr. Green will be appointed to the command of the best that may be put in commission. But this they will do *as matter of course*:—there is no instance upon record of their having appointed to any post or employment an inefficient person.

It was about a quarter past nine, and quite dark. Four of the party returned to town: five remained to take charge of the balloon. And here we had for companions nearly five hundred of as pleasant persons as ever made odds against five. They were composed chiefly of the veriest rabble that Stepney, Ratcliffe, Limehouse, Poplar, and the eastern outskirts of London could disgorge. "Never till now stood I in such a presence!" These disinterested gentry had followed us from their respective quarters with the amiable intention of rendering assistance, as they said; but as their assistance had not been required, their claims for payment for their disinterestedness were rejected. Our captain then ordered all hands on board—that is, that we should resume our places in the car—whilst he, in the hope of inducing our kind friends to leave us, informed them that his intention was to remain on the heath all night, preparatory to a fresh start at daylight. To discharge his balloon in their presence he dared not, for they would undoubtedly have cut it to pieces:—not for the value of the silk and cordage, but merely as specimens for their scrap-books and albums:—just as other collectors do sometimes tear prints out of books in libraries, public or private, as ornaments for their own portfolios. Then came their yells, their savage imprecations, "curses both loud and deep;" their threats to destroy the balloon, an intention which I am satisfied was only not fulfilled from a difference of opinion amongst them, touching the best mode of carrying it into execution. To us these divisions in the enemies' camp (or cabinet, if you will) was a victory—for both in camps and cabinets divisions tend to the success of the opposite party. At length, wearied by

unprofitable attendance upon us, by twos and fives and tens they dispersed; till, at about eleven o'clock, we were left with some dozen or fifteen men belonging to the neighbourhood, who were useful and civil too. And now you may understand what it was that induced my seemingly out-of-place question, touching the first Lord Thurlow.

By midnight the balloon was gathered in and packed up; and within half an hour afterwards we were seated at a comfortable deal table, at a road-side public-house—the "Eagle and Child"—(mercy upon eagle, or child either, that had happened at that moment to fall in the way of our hunger!)—and regaled with the best the larder and cellar afforded: such bread-and-cheese and ale, Tom!—Ude's most exquisite achievements assisted by Brind's best claret, might without dishonour have doffed caps to it.

Did you ever see the death, or, rather, the killing, of a balloon? To be in at the death of the "Great Nassau" was a fine sight, and an ample compensation for the inconveniences and discomforts just preceding it. Remember, the night was dark! Daylight would have marred the effect. There was the huge monster which, but a little while ago, had flown away with nine of us dangling at its tail, pinned down to the ground. Its grand and graceful form stood out in bold relief against the sombre sky. It had already been crippled by the expulsion of some quantity of its breath of life, but it was not a creature to surrender its existence at a blow. Its destruction was a work of time, and, as the work proceeded, it heaved and panted and groaned, till, its throes becoming fainter and fainter, it finally gave up the gas and lay stretched on the earth—as flat as a pancake! And there's a touch of the sublime for you.

And now that huge, swollen, and swaggering creature, which had lately astonished all beholders, was folded up and placed at the bottom of its own little car, leaving still room above it sufficient to accommodate another of its own proportions! Yet in that there was nothing to wonder at. Had it been self-sustained? No! Gas—*puffery!*—had been its main support. Tom; I quitted the ground with a moral lesson in my pocket; and it were to be wished that all travellers, whether by land, sea, or air, were as great gainers by their excursions.

I had nearly overlooked one of your questions, which is, whether I would advise you to try a balloon-trip. I would not dissuade you from it, because, with MR. GREEN *for your conductor*—I say this to you with "good emphasis" and, let me add, "sound discretion"—the danger of the adventure is reduced to the lowest possible point; but I would not for any consideration incur the responsibility of *inducing* you to tempt a region where, should an accident occur—and balloons are but silk, balloonatics but men—the consequences, beyond all human skill and prudence to avert or to remedy, must be fatal. Now, I can fancy the happy state of indecision in which this prudent counsel will have placed your mind. But here is something positive for you, just to give it an inclination. Do not go up in a parachute, nor with fireworks, nor with even the tamest tiger that, as yet, stands unconvicted of having made minced meat of a man.

We all know the fate of that poor simpleton, Cocking (see p. 164); so much for parachutes!

I was one of the thousands who saw (and I *heard* it too) the destruction of Madame Blanchard (7th July, 1819). On the evening of the 6th July, 1819, she ascended in a balloon from the Tivoli Gardens at Paris. At a certain elevation she was to discharge some fireworks which were attached to her car. From my own windows I saw the ascent. For a few minutes the balloon was concealed by clouds. Presently it reappeared, and there was seen a momentary sheet of flame. There was a dreadful pause. In a few seconds, the poor creature, enveloped and entangled in the netting of her machine, fell with a frightful crash upon the slanting roof of a house in the Rue de Provence (not a hundred yards from where I was standing), and thence into the street, and Madame Blanchard was taken up a shattered corpse! It was supposed that the rockets which ought to have been made to point *downwards* were improperly managed; and thus the catastrophe was accounted for. So much for firework ascents!

Of tiger-ascents the results are yet unknown, though they may easily be guessed at in the event of an accident either above or below. I have already enlightened you with my opinion as to the *utility* of ballooning: let that pass for just so little as it may be worth; but I entertain serious doubts as to whether parachutes, or even firework ascents can be rendered serviceable to science in any of its branches—unless coffin-making be reckoned of the number. Tigers, however, have not yet been put upon their trial; so, till they have, we will give them the benefit of the humane maxim of the English law.

Now, of these three exhibitions, two are both brutal and stupid; and the best that can be said of the squib-and-cracker affair is, that, childish as it is, you get in return for the endangering of human life, a pretty

show to stare at. That is something, certainly. But don't you be induced to join any of those parties; and should your brother Dick, who is now in the commission of the peace, give the weight of his sanction to such mischievous fooleries, even by winking at them, he will deserve to be degraded from his trust.

But, to return—to the subject, and to town, at the same time. The "Eagle and Child" being by no means so well provided with lodging as with refreshments, only two of our party could be accommodated in the former respect; and conveyances being nowhere procurable at that late hour, shortly after one o'clock, A.M., three of the "intrepid aeronauts" (*vide* newspapers) marched to London, where we arrived, as well as could be expected, not long after four.

I should not have noticed this occurrence but that it led to an extraordinary result. Upon my return to town, fatigued by my walk, I threw myself into an easy-chair and fell into—what do you think?—a *reverie!* Now, though *reveries* were formerly much in vogue upon occasions like the present, I cannot recollect an instance of an accident of the kind befalling any writer within the present century.

Well; I fell into a *reverie*, and (my head still full of the balloon) I fancied the balloon a statesman, and its conductor, Mr. Fee'dwell, a hireling, parasitical puff-writer, and *special Cad to a Literary Omnibus.* Fee'dwell inflated the Statesman with his puffs, and the Statesman presently swelled to the dimensions of a Chatham, a Pitt, a Fox—all three in one!

Next, a Secretary of State for the ——. But, hold! I am looking out for a pension; so upon this subject not a word more even to you, Tom.

Next, a Poet:—Milton, Pope, and Dryden—Byron, Campbell, and Rogers, were each, and all together, his inferiors.

The balloon then became a Painter, and, by the aid of its gas diploma, it was presently swollen into a Rubens!—more gas, and it distended to a Titian!—more gas, and more—"And now," cries the puffster, "up with you, my own-made modern Michael Angelo!" "What you have made me take me," responds the painter-balloon; "but keep the gas up;* for if you, allow me to sink but a foot, you'll find short commons at your next visit to —— Street."

Next a Dramatist: and the parasite so be-Congreve'd and be-Massinger'd, so be-Sheridan'd and be-Shakspeare'd him, that I really thought the poor balloon must have burst!

Next, a Novel-writer:—Up we go; Goldsmith and Sterne are invisible; Swift, Richardson, and Fielding, dwindled into specks! "Higher still with me!" cries the Novel-writer; "more gas for me, my prince of parasites! Pence or pudding, which you will; but more gas for me, more gas!"—"Up, up, up, my unparalleled balloon," cries the inflator: "I'm doing it for you: another puff or two and you shall have left the whole world of novelists, romancers, and essayists, immeasurably below you."

Here methought the smell of the gas became offensive, almost beyond endurance, and I complained of it to Fee'dwell. "Excuse the word," said I, "but it stinks; it is so coarse and strong that the stomach of a dray-horse would reject it: the whole town sickens at it."

Not so with the balloons it is my business to inflate," replied he: "their stomachs are not so delicate: the stronger it is, the better they relish it. Besides, I do not pretend to the refined art of producing gas from myrrh, and frankincense, and aromatic herbs, nor would they relish it if I could: that would not elevate them a tenth part high enough to please them. No, no; coarse coal-gas is the thing for our purpose, and the coarser the better."

The next and last metamorphosis of the balloon was into a whole company of actors; and I own I wished myself safely out of it, for, now, there was considerable danger of an "awful calamity." Such a clamour! such cries of "Gas! gas! more gas! more!" that an explosion seemed to be inevitable. I expressed my apprehensions upon the subject.

"There is less danger of such a catastrophe now than ever," said the puffster: "this balloon will swallow more gas, or, in other words, has a greater capacity for distension than any of the others: cram it as you will, it never thinks itself sufficiently inflated."

"Surely," said I, "the machine is rising very sluggishly. What is its present altitude?"

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* I need not inform you, Tom, that the substitution of the increase of gas for the diminishing of the quantity of ballast to produce the required effect, is one of those whimsical blunders to which, in dreams and reveries, we are subject.

THE ASCENDANCY
Well take a flight To Heaven to night
And leave dull Earth behind us
We'll watch their flights
Well they will Let them Alone
Blown up by God! not one Soul left aboard
Property insured for any Journey on Earth
Lives Assured at the Booking Office
PATENT SAFETY COACH

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c.Director.*

1864

Fee'dwell requested me to look at the HISTRIONOMETER which was hanging within the netting. I did so, and found it wavering between one degree below, and one degree above, the point of *Mediocrity*.

"Ay," said Fee'dwell (but rather muttering these words to himself than addressing them to me), "and, confound it! at *Mediocrity* it will dangle till doomsday unless I give it a puff or two."

"How high am I, my dear Fee'dwell?" cried a voice, which I recognised to be that of Mr. Horsecollar, a second-rate comic actor.

"Between ourselves," replied the puffster, referring to the Histrionometer, "between ourselves, Mr. Horsecollar, you stand at about *Pleasant and Tolerable*."

"More gas, more gas, my good, kind puffster!" cried Horsecollar; at the same time thrusting a bundle of playhouse orders into the hand of the "good, kind" person he was addressing.

The puffster, who dared not for his life leave hold of his valve-line, lest the gas should escape and tumble his whole cargo to the ground, requested me to throw over a bag of ballast, one of the smallest I could find. I stooped down, and, at the bottom of the car, perceived a small number of tiny bags, varying in weight from a quarter of an ounce to an ounce, each labelled, "JUDGMENT." I emptied out a quarter of an ounce of this ballast, and the balloon shot upwards with amazing rapidity.

"Where am I now?" continued the same voice.

"Within two degrees of *Liston*," replied the puffster, watching the progress of the mercury and reporting accordingly, "You are now *at Liston* exactly—two—three—ten—twenty degrees above him."

"Bravo!" said Horsecollar; "but give me a little more gas, my dear boy."

Another little bag of ballast was discharged, the machine continued to rise, and the report was continued:—

"Fifty degrees—all to nothing above him—and above *Fawcett*—and *Munden*—and—and—everybody else."

"More gas, more!" continued the cormorant.

But he was interrupted by other claimants, the first of whom was Miss Laura Leadenlegs, a dancer. Something was whispered about "a de*late*ful *leetle feet-shampeter* to be given at Twitnim by Lord Gullborough (who was greatly interested in her *per*fessional *edvencemunt*), and at which she would be permitted to *interdoose* a *frind*:" and up went Miss Leadenlegs from *Detestable* to within two degrees of *Taglioni!*

Then came Mr. Ravenscroak (a pupil just launched of Mr. Snacks', the singing-master). I didn't hear what he said, but from *Passable*, up he was carried through *Templeton—Wilson—Phillips*—even to *Rubini*-mark. But the cry was still for "gas, more gas!"

Mr. Simper, the genteel, and lively-comedy-man, who stood at *Mediocrity*, was rapidly raised above *Richard Jones* and *Lewis;* and it is hard to say where he might have been carried had he not been thrust aside by Mr. O'Shamrock, the Irishman of the company.

"My darling boy, my dear duck of a fellow, what's my mark?" cried O'Shamrock.

"Your *true* mark, my dear Shammy, is *Vastly Pleasant*, but——"

"And is it my true mark you're after talking about? Up with me, you spalpane! Have you forgot to re*mim*ber where you're engaged to dine next Sunday, at half-past nine?"

The puffster requested me to throw over a whole ounce of ballast, and another, and another; and the balloon being lightened of such a weight of JUDGMENT, rose till the Histrionometer indicated ten degrees above *Irish Johnstone*.

"Johnstone be d—d!" cried O'Shamrock. "But up with me, my Oracle! Don't forget Sunday, my unparalleled puffster; so up with me, and say what I am for tipping an elegant audience, and the true *connyshures*, a touch of the *jontale*."

Out went bag after bag, and at each rise the puffster answered, "For elegant comedy you are now at *Jones*—and *Lewis*—and *Elliston*—"

"Accept this little wooden snuff-box, my darling of the world. It's ugly-looking enough, but it's the greatest *curossyty* in all Europe: it belonged to St. Patrick himself! If you doubt it, I'll have it engraved on the lid, for proof. So up with me again, my critic of critics."

"Now we are passing *John Palmer*—and now I have puffed you up, even to *Charles Kemble*. Are you satisfied?"

"And is it satisfied you're after *ma*ning?" said O'Shamrock. "Och! by my shillelagh! and if you are after

going to come your 'satisfied' over me, so long as there is sky-room above us, hand me back St. Patrick's snuff-box; and please to do me the pleasure *not* to dine with me next Sunday at half-past nine, you niggardly spalpane."

Lastly came Mr. Daggerbowl, the tragedian. What was *his* standing-point I did not observe; but having discharged sundry of the little bags, the Histrionometer indicated first, *Charles Young*, then JOHN KEMBLE! I trembled for our safety, for this was a fearful height to tumble from!

"Higher, higher!" cried Daggerbowl. "What am I now, my profound?"

"And *Garrick*," responded the parasite, referring to the indicator.

"That won't do for me, my deep-searching puffster: higher, more gas, higher!"

"Ay, ay, sir, up we go!"

"What am I *now*, my widely-grasping and all-embracing puffster?"

"And *Mossop*," replied the parasite:—up we go!—And *Barry*—up we go!—And *Betterton*. Now we are at *Surpassing!*—now at *Transcendant!*—now at *Never-approached!*—and now at *Unapproachable-and-never-in-this-world-to-be-equalled!* Are *you* satisfied, O super-human, O Heaven-inspired Daggerbowl?"

"Higher, good puffster! Higher still, dear parasite!" cried Daggerbowl.

Here the whole company was seized with the mania of jealousy, each desiring to be carried as high (or, in the language of the earth, to be as unsparingly bepuffed) as Mr. Daggerbowl. Their cries of "Higher! higher!" "More gas for *me!*" "And *me!*" "And *me!*" were deafening. But the last tiny bag of JUDGMENT having been exhausted, it was impossible for the still willing parasite to comply with their demands. *Finding he could do no more for them*, from requests they proceeded to commands, from commands to threats: till at length the puffster, provoked by what he called "their surpassing ingratitude," and warned of his own danger by the rocking of his unballasted and over-inflated balloon, drew his valve-line and, gradually emitting the gas, gently let his whole cargo of Statesman, Poet, Dramatist, Painter, Novelist, and Player, each down to his safe and proper level.

And is it possible, thought I, that a high-minded balloon, whether in the form of Poet or Player, or any other of a polite or liberal occupation, can so degrade itself as to place its valve-line in the hands of one who, at the best, can give it but a temporary elevation, if unmerited; as, at the worst, whether in caprice or malice, he can but for a time depress it! O Balloon! there stands one, your best reliance, whose name is PUBLIC; who, though he may be made for a while to stare with wonder at your fantastic vagaries when placed too high in air, yet sooner or later will reflection come to his aid, and remind him that there you are supported only by an overcharge of gas, noisome gas. Then will he seize you by your grapnel, and, despite your parasitical inflater, place you at your just point of elevation—neither allowing you to rise much above, nor to sink much below it. Renounce, then, O Balloon! manfully and at once renounce a support not less degrading than insecure; upon which relying and of which to be bereft, you will fall, fall, fall, a thing for mockery and scorn.

Scarcely had I concluded this reflection, when MR. PUBLIC (with a smile of good-humoured contempt) just blowing upon the balloon, the monstrous bubble burst with so loud a report that, &c. &c.

And now, my dear Tom, having only to add that (with all proper regard for the revenue) this long, rambling epistle being [not] "*On Her Majesty's Service*," you will receive it, as such, under an official frank. I conclude by subscribing myself

One of your most sincere friends now on Earth,

To —— ——, Esq. P*.

One of Edgar Poe's imaginative Tales well deserves a place in this chapter, it is entitled—

"THE UNPARALLELED ADVENTURE OF HANS PFAALL."

With a heart of furious fancies,
Whereof I am commander,
With a burning spear, *and a horse of air*,
To the wilderness I wander.
*Tom o' Bedlam's Song.*

By late accounts from Rotterdam, that city seems to be in a high state of philosophical excitement. Indeed, phenomena have there occurred of a nature so completely unexpected, so entirely novel, so utterly at variance

with preconceived opinions, as to leave no doubt on my mind that long ere this all Europe is in an uproar, all physics in a ferment, all reason and astronomy together by the ears.

It appears that on the —— day of —— (I am not positive about the date), a vast crowd of people, for purposes not specifically mentioned, were assembled in the great square of the Exchange in the well-conditioned city of Rotterdam. The day was warm—unusually so for the season—there was hardly a breath of air stirring; and the multitude were in no bad humour at being now and then besprinkled with friendly showers of momentary duration, that fell from large white masses of cloud profusely distributed about the blue vault of the firmament. Nevertheless, about noon, a slight but remarkable agitation became apparent in the assembly; the clattering of ten thousand tongues succeeded; and, in an instant afterwards, ten thousand faces were upturned towards the heavens, ten thousand pipes descended simultaneously from the corners of ten thousand mouths, and a shout, which could be compared to nothing but the roaring of Niagara, resounded long, loudly, and furiously, through all the city and through all the environs of Rotterdam.

The origin of this hubbub soon became sufficiently evident. From behind the huge bulk of one of those sharply-defined masses of cloud already mentioned, was seen slowly to emerge into an open area of blue space, a queer, heterogeneous, but apparently solid substance, so oddly shaped, so whimsically put together, as not to be in any manner comprehended, and never to be sufficiently admired, by the host of sturdy burghers who stood open-mouthed below. What could it be? In the name of all the devils in Rotterdam, what could it possibly portend? No one knew; no one could imagine; no one—not even the burgomaster Mynheer Superbus Von Underduk—had the slightest clue by which to unravel the mystery; so, as nothing more reasonable could be done, every one, to a man, replaced his pipe carefully in the corner of his mouth, and, maintaining an eye steadily upon the phenomenon, puffed, paused, waddled about, and grunted significantly—then waddled back, grunted, paused, and finally—puffed again.

In the mean time, however, lower and still lower towards the goodly city, came the object of so much curiosity, and the cause of so much smoke. In a very few minutes it arrived near enough to be accurately discerned. It appeared to be—yes! it *was* undoubtedly a species of balloon; but surely no *such* balloon had ever been seen in Rotterdam before. For who, let me ask, ever heard of a balloon manufactured entirely of dirty newspapers? No man in Holland, certainly; yet here, under the very noses of the people, or rather at some distance *above* their noses, was the identical thing in question, and composed—I have it on the best authority—of the precise material which no one had ever before known to be used for a similar purpose. It was an egregious insult to the good sense of the burghers of Rotterdam. As to the shape of the phenomenon, it was even still more reprehensible, being little or nothing better than a huge fool's-cap turned upside down. And this similitude was regarded as by no means lessened, when, upon nearer inspection, the crowd saw a large tassel depending from its apex, and, around the upper rim or base of the cone, a circle of little instruments, resembling sheep-bells, which kept up a continual tinkling to the tune of Betty Martin. But, still worse, suspended by blue ribbons to the end of this fantastic machine, there hung, by way of car, an enormous drab beaver hat, with a brim superlatively broad, and a hemispherical crown with a black band and a silver buckle. It is, however, somewhat remarkable that many citizens of Rotterdam swore to having seen the same hat repeatedly before; and, indeed, the whole assembly seemed to regard it with eyes of familiarity; while the vrow Grettel Pfaall upon sight of it uttered an exclamation of joyful surprise, and declared it to be the identical hat of her good man himself. Now this was a circumstance the more to be observed, as Pfaall, with three companions, had actually disappeared from Rotterdam about five years before, in a very sudden and unaccountable manner, and up to the date of this narrative all attempts at obtaining intelligence concerning them had failed. To be sure, some bones, which were thought to be human, mixed up with a quantity of odd-looking rubbish, had been lately discovered in a retired situation to the east of the city; and some people went so far as to imagine that in this spot a foul murder had been committed, and that the sufferers were in all probability Hans Pfaall and his associates. But to return.

The balloon (for such no doubt it was) had now descended to within a hundred feet of the earth, allowing the crowd below a sufficiently distinct view of the person of its occupant. This was in truth a very singular body. He could not have been more than two feet in height; but this altitude, little as it was, would have been sufficient to destroy his equilibrium, and tilt him over the edge of his tiny car, but for the intervention of a circular rim reaching as high as the breast, and rigged on to the cords of the balloon. The body of the little man was more than proportionally broad, giving to his entire figure a rotundity highly absurd. His feet, of course, could

not be seen at all. His hands were enormously large. His hair was grey, and collected into a *queue* behind. His nose was prodigiously long, crooked, and inflammatory; his eyes full, brilliant, and acute; his chin and cheeks, although wrinkled with age, were broad, puffy, and double; but of ears of any kind there was not a semblance to be discovered upon any portion of his head. This odd little gentleman was dressed in a loose surtout of sky-blue satin, with tight breeches to match, fastened with silver buckles at the knees. His vest was of some bright yellow material; a white taffety cap was set jauntily on one side of his head; and, to complete his equipment, a blood-red silk handkerchief enveloped his throat, and fell down in a dainty manner upon his bosom, in a fantastic bow-knot of super-eminent dimensions.

Having descended, as I said before, to about one hundred feet from the surface of the earth, the little old gentleman was suddenly seized with a fit of trepidation, and appeared disinclined to make any nearer approach to *terra firma*. Throwing out, therefore, a quantity of sand from a canvas bag, which he lifted with great difficulty, he became stationary in an instant. He then proceeded, in a hurried and agitated manner, to extract from a side pocket in his surtout a large morocco pocket-book. This he poised suspiciously in his hand; then eyed it with an air of extreme surprise, and was evidently astonished at its weight. He at length opened it, and, drawing therefrom a huge letter sealed with red sealingwax, and tied carefully with red tape, let it fall precisely at the feet of the burgomaster Superbus Von Underduk. His Excellency stooped to take it up. But the aeronaut, still greatly discomposed, and having apparently no further business to detain him in Rotterdam, began at this moment to make busy preparations for departure; and it being necessary to discharge a portion of ballast to enable him to reascend, the half dozen bags which he threw out, one after another, without taking the trouble to empty their contents, tumbled, every one of them, most unfortunately, upon the back of the burgomaster, and rolled him over and over no less than half-a-dozen times, in the face of every individual in Rotterdam. It is not to be supposed, however, that the great Underduk suffered this impertinence on the part of the little old man to pass off with impunity. It is said, on the contrary, that during each of his half-dozen circumvolutions he emitted no less than half a dozen distinct and furious whiffs from his pipe, to which he held fast the whole time with all his might, and to which he intends holding fast—God willing—until the day of his decease.

In the mean time the balloon arose like a lark, and, soaring far away above the city, at length drifted quietly behind a cloud similar to that from which it had so oddly emerged, and was thus lost for ever to the wondering eyes of the good citizens of Rotterdam. All attention was now directed to the letter, the descent of which, and the consequences attending thereupon, had proved so fatally subversive of both person and personal dignity to his Excellency Von Underduk. That functionary, however, had not failed, during his circumgyratory movements, to bestow a thought upon the important object of securing the epistle, which was seen, upon inspection, to have fallen into the most proper hands, being actually addressed to himself and Professor Rubadub, in their official capacities of President and Vice-President of the Rotterdam College of Astronomy. It was accordingly opened by those dignitaries upon the spot, and found to contain the following extraordinary, and, indeed, very serious communication:—

*To their Excellencies Von Underduk and Rubadub, President and Vice-President of the States' College of Astronomers, in the City of Rotterdam.*

Your Excellencies may, perhaps, be able to remember an humble artisan, by name Hans Pfaall, and by occupation a mender of bellows, who, with three others, disappeared from Rotterdam, about five years ago, in a manner which must have been considered unaccountable. If, however, it so please your Excellencies, I the writer of this communication, am the identical Hans Pfaall himself. It is well known to most of my fellow-citizens that for the period of forty years I continued to occupy the little square brick building at the head of the alley called Sauerkraut, in which I resided at the time of my disappearance. My ancestors have also resided therein time out of mind—they, as well as myself, steadily following the respectable, and, indeed, lucrative, profession of mending of bellows; for, to speak the truth, until of late years, that the heads of all the people have been set agog with politics, no better business than my own could an honest citizen of Rotterdam either desire or desire. Credit was good, employment was never wanting, and there was no lack of either money or good will. But, as I was saying, we soon began to feel the effects of liberty, and long speeches, and radicalism, and all that sort of thing. People who were formerly the very best customers in the world, had now not a moment of time to think of us at all. They had as much as they could do to read about the revolutions, and keep up with the march

of intellect and the spirit of the age. If a fire wanted fanning, it could readily be fanned with a newspaper; and, as the Government grew weaker, I have no doubt that leather and iron acquired durability in proportion; for, in a very short time, there was not a pair of bellows in all Rotterdam that ever stood in need of a stitch, or required the assistance of a hammer. This was a state of things not to be endured. I soon grew as poor as a rat, and, having a wife and children to provide for, my burdens at length became intolerable, and I spent hour after hour in reflecting upon the most convenient method of putting an end to my life. Duns, in the mean time, left me little leisure for contemplation. My house was literally besieged from morning till night. There were three fellows in particular, who worried me beyond endurance, keeping watch continually about my door, and threatening me with the law. Upon these three I vowed the bitterest revenge, if ever I should be so happy as to get them within my clutches; and I believe nothing in the world but the pleasure of this anticipation prevented me from putting my plan of suicide into immediate execution, by blowing my brains out with a blunderbuss. I thought it best, however, to dissemble my wrath, and treat them with promises and fair words, until, by some good turn of fate, an opportunity of vengeance should be afforded me.

One day, having given them the slip, and feeling more than usually dejected, I continued for a long time to wander about the most obscure streets without object, until at length I chanced to stumble against the corner of a bookseller's stall. Seeing a chair close at hand for the use of customers, I threw myself doggedly into it, and, hardly knowing why, opened the pages of the first volume which came within my reach. It proved to be a small pamphlet treatise on Speculative Astronomy, written either by Professor Encke, of Berlin, or by a Frenchman of somewhat similar name. I had some little tincture of information on matters of this nature, and soon became more and more absorbed in the contents of the book—reading it actually through twice before I awoke to a recollection of what was passing around me. By this time it began to grow dark, and I directed my steps towards home. But the treatise (in conjunction with a discovery in pneumatics, lately communicated to me as an important secret by a cousin from Nantz) had made an indelible impression on my mind; and, as I sauntered along the dusky streets, I revolved carefully over in my memory the wild, and sometimes unintelligible, reasonings of the writer. There are some particular passages which affected my imagination in an extraordinary manner. The longer I meditated upon these, the more intense grew the interest which had been excited within me. The limited nature of my education in general, and more especially my ignorance on subjects connected with natural philosophy, so far from rendering me diffident of my own ability to comprehend what I had read, or inducing me to mistrust the many vague notions which had arisen in consequence, merely served as a further stimulus to imagination; and I was vain enough, or, perhaps, reasonable enough, to doubt whether those crude ideas which, arising in ill-regulated minds, have all the appearance, may not often in effect possess all the force, the reality, and other inherent properties of instinct or intuition.

It was late when I reached home, and I went immediately to bed. My mind, however, was too much occupied to sleep, and I lay the whole night buried in meditation. Arising early in the morning, I repaired eagerly to the bookseller's stall, and laid out what little ready money I possessed in the purchase of some volumes of Mechanics and Practical Astronomy. Having arrived at home safely with these, I devoted every spare moment to their perusal, and soon made such proficiency in studies of this nature as I thought sufficient for the execution of a certain design with which either the devil or my better genius had inspired me. In the intervals of this period I made every endeavour to conciliate the three creditors who had given me so much annoyance. In this I finally succeeded, partly by selling enough of my household furniture to satisfy a moiety of their claim, and partly by a promise of paying the balance upon completion of a little project which I told them I had in view, and for assistance in which I solicited their services. By these means (for they were ignorant men) I found little difficulty in gaining them over to my purpose.

Matters being thus arranged, I contrived, by the aid of my wife, and with the greatest secrecy and caution, to dispose of what property I had remaining, and to borrow in small sums, under various pretences, and without giving any attention, I am ashamed to say, to my future means of repayment, no inconsiderable quantity of ready money. With the means thus accruing I proceeded to procure, at intervals, cambric muslin, very fine, in pieces of twelve yards each; twine; a lot of the varnish of caoutchouc; a large and deep basket of wickerwork, made to order; and several other articles necessary in the construction and equipment of a balloon of extraordinary dimensions. This I directed my wife to make up as soon as possible, and gave her all requisite information as to the particular method of proceeding. In the mean time I worked up the twine into network of sufficient

dimensions, rigged it with a hoop and the necessary cords, and made purchase of numerous instruments and materials for experiment in the upper regions of the upper atmosphere. I then took opportunities of conveying by night, to a retired situation east of Rotterdam, five iron-bound casks, to contain about fifty gallons each, and one of a larger size; six tin tubes, three inches in diameter, properly shaped, and ten feet in length; a quantity of a *particular metallic substance, or semi-metal*, which I shall not name, and a dozen demijohns of *a very common acid*. The gas to be formed from these latter materials is a gas never yet generated by any other person than myself, or, at least never applied to any similar purpose. I can only venture to say here, that it is *a constituent of azote*, so long considered irreducible, and that its density is about 37·4 times *less than that of hydrogen*. It is tasteless, but not odourless; burns, when pure, with a greenish flame, and instantaneously fatal to animal life. Its full secret I would make no difficulty in disclosing, but that it of right belongs, as I have before hinted, to a citizen of Nantes, in France, by whom it was conditionally communicated to myself. The same individual submitted to me, without being at all aware of my intentions, a method of constructing balloons from the membrane of a certain animal, through which substance any escape of gas was nearly an impossibility. I found it, however, altogether too expensive, and was not sure, upon the whole, whether cambric muslin, with a coating of gum-caoutchouc, was not equally as good. I mention this circumstance, because I think it probable that hereafter the individual in question may attempt a balloon ascension with the novel gas and material I have spoken of, and I do not wish to deprive him of the honour of a very singular invention.

On the spot which I intended each of the smaller casks to occupy respectively during the inflation of the balloon, I privately dug a small hole; the holes forming in this manner a circle twenty-five feet in diameter. In the centre of this circle, being the station designed for the large cask, I also dug a hole of greater depth. In each of the five smaller holes I deposited a canister containing fifty pounds, and in the larger one a keg holding one hundred and fifty pounds, of cannon-powder. These—the keg and the canisters—I connected in a proper manner with covered trains; and, having let into one of the canisters the end of about four feet of slow-match, I covered up the hole, and placed the cask over it, leaving the other end of the match protruding about an inch, and barely visible beyond the cask. I then filled up the remaining holes, and placed the barrels over them in their destined situation.

Besides the articles above enumerated, I conveyed to the *dépôt*, and there secreted, one of M. Grimm's improvements upon the apparatus for condensation of the atmospheric air. I found this machine, however, to require considerable alteration before it could be adapted to the purposes to which I intended making it applicable. But, with severe labour and unremitting perseverance, I at length met with entire success in all my preparations. My balloon was soon completed. It would contain more than forty thousand cubic feet of gas; would take me up easily, I calculated, with all my implements, and, if I managed rightly, with one hundred and seventy-five pounds of ballast into the bargain. It had received three coats of varnish, and I found the cambric muslin to answer all the purposes of silk itself, being quite as strong, and a good deal less expensive.

Everything being now ready, I exacted from my wife an oath of secrecy in relation to all my actions from the day of my first visit to the bookseller's stall; and promising, on my part, to return as soon as circumstances would permit. I gave her what little money I had left, and bade her farewell. Indeed, I had no fear on her account. She was what people call a notable woman, and could manage matters in the world without my assistance. I believe, to tell the truth, she always looked upon me as an idle body—a mere makeweight, good for nothing but building castles in the air, and was rather glad to get rid of me. It was a dark night when I bade her good-bye, and taking with me, as *aides-de-camp*, the three creditors who had given me so much trouble, we carried the balloon, with the car and accoutrements, by a roundabout way, to the station where the other articles were deposited. We there found them all unmolested, and I proceeded immediately to business.

It was the first of April. The night, as I said before, was dark; there was not a star to be seen; and a drizzling rain, falling at intervals, rendered us very uncomfortable. But my chief anxiety was concerning the balloon, which, in spite of the varnish with which it was defended, began to grow rather heavy with the moisture; the powder also was liable to damage. I therefore kept my three duns working with great diligence, pounding down ice around the central cask, and stirring the acid in the others. They did not cease, however, importuning me with questions as to what I intended to do with all this apparatus, and expressed much dissatisfaction at the terrible labour I made them undergo. They could not perceive (so they said) what good was likely to result from their getting wet to the skin, merely to take a part in such horrible incantations. I began

to get uneasy, and worked away with all my might; for I verily believe the idiots supposed that I had entered into a compact with the devil, and that, in short, what I was now doing was nothing better than it should be. I was, therefore, in great fear of their leaving me altogether. I contrived, however, to pacify them by promises of payment of all scores in full, as soon as I could bring the present business to a termination. To these speeches they gave, of course, their own interpretation; fancying, no doubt, that at all events I should come into possession of vast quantities of ready money; and, provided I paid them all I owed, and a trifle more, in consideration of their services, I dare say they cared very little what became of either my soul or my carcass.

In about four hours and a half I found the balloon sufficiently inflated. I attached the car, therefore, and put all my implements in it—a telescope; a barometer, with some important modifications; a thermometer; an electrometer; a compass; a magnetic needle; a seconds watch; a bell; a speaking-trumpet, &c. &c. &c.; also a globe of glass, exhausted of air, and carefully closed with a stopper; not forgetting the condensing apparatus, some unslacked lime, a stick of sealingwax, a copious supply of water, and a large quantity of provisions, such as pemmican, in which much nutriment is contained in comparatively little bulk. I also secured in the car a pair of pigeons and a cat.

It was now nearly daybreak, and I thought it high time to take my departure. Dropping a lighted cigar on the ground, as if by accident, I took the opportunity, in stooping to pick it up, of igniting privately the piece of slow-match, the end of which, as I said before, protruded a little beyond the lower rim of one of the smaller casks. This manœuvre was totally unperceived on the part of the three duns; and, jumping into the car, I immediately cut the single cord which held me to the earth, and was pleased to find that I shot upwards with inconceivable rapidity, carrying with all ease one hundred and seventy-five pounds of leaden ballast, and able to have carried up as many more. As I left the earth, the barometer stood at thirty inches, and the centigrade thermometer at 19°.

Scarcely, however, had I attained the height of fifty yards when, roaring and rumbling up after me in the most tumultuous and terrible manner, came so dense a hurricane of fire, and gravel, and burning wood, and blazing metal, and mangled limbs, that my very heart sunk within me, and I fell down in the bottom of the car, trembling with terror. Indeed, I now perceived that I had entirely overdone the business, and that the main consequences of the shock were yet to be experienced. Accordingly in less than a second, I felt all the blood in my body rushing to my temples, and, immediately thereupon, a concussion, which I shall never forget, burst abruptly through the night, and seemed to rip the very firmament asunder. When I afterwards had time for reflection, I did not fail to attribute the extreme violence of the explosion as regarded myself, to its proper cause—my situation directly above it, and in the line of its greatest power. But at the time I thought only of preserving my life. The balloon at first collapsed, then furiously expanded, then whirled round and round with sickening velocity, and finally, reeling and staggering like a drunken man, hurled me over the rim of the car, and left me dangling, at a terrific height, with my head downward, and my face outward, by a piece of slender cord about three feet in length, which hung accidentally through a crevice near the bottom of the wickerwork, and in which, as I fell, my left foot became most providentially entangled. It is impossible—utterly impossible—to form any adequate idea of the horror of my situation. I gasped convulsively for breath—a shudder resembling a fit of the ague agitated every nerve and muscle in my frame—I felt my eyes starting from their sockets—a horrible nausea overwhelmed me—and at length I lost all consciousness in a swoon.

How long I remained in this state it is impossible to say. It must, however, have been no inconsiderable time, for when I partially recovered the sense of existence, I found the day breaking, the balloon at a prodigious height over a wilderness of ocean, and not a trace of land to be discovered far and wide within the limits of the vast horizon. My sensations, however, upon thus recovering, were by no means so replete with agony as might have been anticipated. Indeed, there was much of madness in the calm survey which I began to take of my situation. I drew up to my eyes each of my hands, one after the other, and wondered what occurrence could have given rise to the swelling of the veins, and the horrible blackness of the finger-nails. I afterwards carefully examined my head, shaking it repeatedly, and feeling it with minute attention, until I succeeded in satisfying myself that it was not, as I had more than half suspected, larger than my balloon. Then, in a knowing manner, I felt in both my breeches-pockets, and, missing therefrom a set of tablets and a toothpick-case, endeavoured to account for their disappearance, and, not being able to do so, felt inexpressibly chagrined. It now occurred to me that I suffered great uneasiness in the joint of my left ankle, and a dim consciousness of my situation began to

glimmer through my mind. But, strange to say, I was neither astonished nor horror-stricken. If I felt any emotion at all, it was a kind of chuckling satisfaction at the cleverness I was about to display in extricating myself from this dilemma; and never for a moment did I look upon my ultimate safety as a question susceptible of doubt. For a few minutes I remained wrapped in the profoundest meditation. I have a distinct recollection of frequently compressing my lips, putting my forefinger to the side of my nose, and making use of other gesticulations and grimaces common to men who, at ease in their arm-chairs, meditate upon matters of intricacy or importance. Having, as I thought, sufficiently collected my ideas, I now, with great caution and deliberation, put my hands behind my back, and unfastened the large iron buckle which belonged to the waistband of my pantaloons. This buckle had three teeth, which, being somewhat rusty, turned with great difficulty on their axis. I brought them, however, after some trouble, at right angles to the body of the buckle, and was glad to find them remain firm in that position. Holding within my teeth the instrument thus obtained, I now proceeded to untie the knot of my cravat. I had to rest several times before I could accomplish this manœuvre; but it was at length accomplished. To one end of the cravat I then made fast the buckle, and the other end I tied, for greater security, tightly round my wrist. Drawing now my body upwards, with a prodigious exertion of muscular force I succeeded, at the very first trial, in throwing the buckle over the car, and entangling it, as I had anticipated, in the circular rim of the wickerwork.

My body was now inclined towards the side of the car, at an angle of about forty-five degrees; but it must not be understood that I was therefore only forty-five degrees below the perpendicular. So far from it, I still lay nearly level with the plane of the horizon; for the change of situation which I had acquired had forced the bottom of the car considerably outward from my position, which was accordingly one of the most imminent peril. It should be remembered, however, that when I fell, in the first instance, from the car, if I had fallen with my face turned towards the balloon, instead of turned outwardly from it, as it actually was—or if, in the second place, the cord by which I was suspended had chanced to hang over the upper edge, instead of through a crevice near the bottom of the car—I say it may readily be conceived that, in either of these supposed cases, I should have been unable to accomplish even as much as I had now accomplished, and the disclosures now made would have been utterly lost to posterity. I had therefore every reason to be grateful; although, in point of fact, I was still too stupid to be anything at all, and hung for perhaps a quarter of an hour in that extraordinary manner, without making the slightest further exertion, and in a singularly tranquil state of idiotic enjoyment. But this feeling did not fail to die rapidly away, and thereunto succeeded horror and dismay, and a sense of utter helplessness and ruin. In fact, the blood so long accumulating in the vessels of my head and throat, and which had hitherto buoyed up my spirits with delirium, had now begun to retire within their proper channels, and the distinctness which was thus added to my perception of the danger merely served to deprive me of the self-possession and the courage to encounter it. But this weakness was, luckily for me, of no very long duration. In good time came to my rescue the spirit of despair, and, with frantic cries and struggles, I jerked my way bodily upwards, till, at length, clutching with a vice-like grip the long-desired rim, I writhed my person over it, and fell headlong and shuddering within the car.

It was not until some time afterwards that I recovered myself sufficiently to attend to the ordinary cares of the balloon. I then, however, examined it with attention, and found it, to my great relief, uninjured. My implements were all safe, and, fortunately, I had lost neither ballast nor provisions. Indeed, I had so well secured them in their places, that such an accident was entirely out of the question. Looking at my watch, I found it six o'clock. I was still rapidly ascending, and the barometer gave a present altitude of three and three-quarter miles. Immediately beneath me in the ocean lay a small black object, slightly oblong in shape, seemingly about the size of a domino, and in every respect bearing a great resemblance to one of those toys. Bringing my telescope to bear upon it, I plainly discerned it to be a British ninety-four gun ship, close-hauled, and pitching heavily in the sea with her head to the W.S.W. Besides this ship, I saw nothing but the ocean and the sky, and the sun, which had long risen.

It is now high time that I should explain to your Excellencies the object of my voyage. Your Excellencies will bear in mind that distressed circumstances in Rotterdam had at length driven me to the resolution of committing suicide. It was not, however, that to life itself I had any positive disgust, but that I was harassed beyond endurance by the adventitious miseries attending my situation. In this state of mind, wishing to live, yet wearied with life, the treatise at the stall of the bookseller, backed by the opportune discovery of my cousin of Nantz,

opened a resource to my imagination. I then finally made up my mind. I determined to depart, yet live—to leave the world, yet continue to exist—in short, to drop enigmas, I resolved, let what would ensue, to force a passage, if I could, *to the moon*. Now, lest I should be supposed more of a madman than I actually am, I will detail, as well as I am able, the considerations which led me to believe that an achievement of this nature, although without doubt difficult and full of danger, was not absolutely, to a bold spirit, beyond the confines of the possible.

The moon's actual distance from the earth was the first thing to be attended to. Now, the mean or average interval between the *centres* of the two planets is 59·9643 of the earth's equatorial *radii*, or only about 237,000 miles. I say the mean or average interval; but it must be borne in mind, that the form of the moon's orbit being an ellipse of eccentricity amounting to no less than 0·05484 of the major semi-axis of the ellipse itself, and the earth's centre being situated in its focus, if I could, in any manner, contrive to meet the moon in its perigee, the above-mentioned distance would be materially diminished. But to say nothing at present of this possibility, it was very certain that, at all events, from the 237,000 miles I would have to deduct the *radius* of the earth, say 4000, and the *radius* of the moon, say 1080, in all 5080, leaving an actual interval to be traversed, under average circumstances, of 231,920 miles. Now this, I reflected, was no very extraordinary distance. Travelling on the land has been repeatedly accomplished at the rate of sixty miles per hour, and, indeed, a much greater speed may be anticipated; but even at this velocity, it would take me no more than 161 days to reach the surface of the moon. There were, however, many particulars inducing me to believe that my average rate of travelling might possibly very much exceed that of sixty miles per hour; and as these considerations did not fail to make a deep impression upon my mind, I will mention them more fully hereafter.

The next point to be regarded was one of far greater importance. From indications afforded by the barometer, we find that, in ascensions from the surface of the earth, we have, at the height of 1000 feet, left below us about one-thirtieth of the entire mass of atmospheric air; that at 10,600, we have ascended through nearly one-third; and that at 18,000, which is not far from the elevation of Cotopaxi, we have surmounted one-half the material, or, at all events, one-half the *ponderable* body of air incumbent upon our globe. It is also calculated that at an altitude not exceeding the hundredth part of the earth's diameter—that is, not exceeding eighty miles—the rarefaction would be so excessive that animal life could in no manner be sustained, and, moreover, that the most delicate means we possess of ascertaining the presence of the atmosphere would be inadequate to assure us of its existence. But I did not fail to perceive that these latter calculations are founded altogether on our experimental knowledge of the properties of air, and the mechanical laws regulating its dilation and compression, in what may be called, comparatively speaking, *the immediate vicinity* of the earth itself; and, at the same time, it is taken for granted that animal life is and must be essentially *incapable of modification* at any given unattainable distance from the surface. Now, all such reasoning and from such *data*, must of course be simply analogical. The greatest height ever reached by man was that of 25,000 feet, attained in the aeronautic expedition of Messieurs Gay-Lussac and Biot. This is a moderate altitude, even when compared with the eighty miles in question; and I could not help thinking that the subject admitted room for doubt and great latitude for speculation.

But, in point of fact, an ascension being made to any given altitude, the ponderable quantity of air surmounted in any *farther* ascension is by no means in proportion to the additional height ascended, as may be plainly seen from what has been stated before, but in a *ratio* constantly decreasing. It is therefore evident that, ascend as high as we may, we cannot, literally speaking, arrive at a limit beyond which *no* atmosphere is to be found. It *must exist*, I argued; although it *may* exist in a state of infinite rarefaction.

On the other hand, I was aware that arguments have not been wanting to prove the existence of a real and definite limit to the atmosphere, beyond which there is absolutely no air whatsoever. But a circumstance which has been left out of view by those who contend for such a limit, seemed to me, although no positive refutation of their creed, still a point worthy very serious investigation. On comparing the intervals between the successive arrivals of Encke's comet at its perihelion, after giving credit, in the most exact manner, for all the disturbances due to the attractions of the planets, it appears that the periods are gradually diminishing; that is to say, the major axis of the comet's ellipse is growing shorter, in a slow but perfectly regular decrease. Now, this is precisely what ought to be the case, if we suppose a resistance experienced from the comet from an extremely *rare ethereal medium* pervading the regions of its orbit. For it is evident that such a medium must, in retarding the comet's velocity, increase its centripetal, by weakening its centrifugal force. In other words, the sun's attraction would be constantly attaining greater power, and the comet would be drawn nearer at every revolution.

Indeed, there is no other way of accounting for the variation in question. But again: The real diameter of the same comet's nebulosity is observed to contract rapidly as it approaches the sun, and dilate with equal rapidity in its departure towards its aphelion. Was I not justifiable in supposing, with M. Valz, that this apparent condensation of volume has its origin in the compression of the same ethereal medium I have spoken of before, and which is dense in proportion to its vicinity to the sun? The lenticular-shaped phenomenon, also, called the zodiacal light, was a matter worthy of attention. This radiance, so apparent in the tropics, and which cannot be mistaken for any meteoric lustre, extends from the horizon obliquely upwards, and follows generally the direction of the sun's equator. It appeared to me evidently in the nature of a rare atmosphere extending from the sun outwards, beyond the orbit of Venus at least, and I believed indefinitely further.* Indeed, this medium I could not suppose confined to the path of the comet's ellipse, or to the immediate neighbourhood of the sun. It was easy, on the contrary, to imagine it pervading the entire regions of our planetary system, condensed into what we call atmosphere at the planets themselves, and perhaps at some of them modified by considerations purely geological; that is to say, modified or varied in its proportions (or absolute nature) by matters volatilised from the respective orbs.

Having adopted this view of the subject, I had little further hesitation. Granting that on my passage I should meet with atmosphere *essentially* the same as at the surface of the earth, I conceived that, by means of the very ingenious apparatus of M. Grimm, I should readily be enabled to condense it in sufficient quantity for the purposes of respiration. This would remove the chief obstacle in a journey to the moon. I had, indeed, spent some money and great labour in adapting the apparatus to the object intended, and confidently looked forward to its successful application, if I could manage to complete the voyage within any reasonable period. This brings me back to the *rate* at which it would be possible to travel.

It is true that balloons, in the first stage of their ascensions from the earth, are known to rise with a velocity comparatively moderate. Now, the power of elevation lies altogether in the superior gravity of the atmospheric air compared with the gas in the balloon; and, at first sight, it does not appear probable that, as the balloon acquires altitude, and consequently arrives successively in atmospheric *strata* of densities rapidly diminishing—I say, it does not appear at all reasonable that, in this its progress upward, the original velocity should be accelerated. On the other hand, I was not aware that, in any recorded ascension, a *diminution* had been proved to be apparent in the absolute rate of ascent; although such should have been the case, if on account of nothing else, on account of the escape of gas through balloons ill constructed, and varnished with no better material than the ordinary varnish. It seemed, therefore, that the effect of such escape was only sufficient to counterbalance the effect of the acceleration attained in the diminishing of the balloon's distance from the gravitating centre. I now considered that, provided in my passage I found the *medium* I had imagined, and provided it should prove to be *essentially* what we denominate atmospheric air, it could make comparatively little difference at what extreme state of rarefaction I should discover it—that is to say, in regard to my power of ascending; for the gas in the balloon would not only be itself subject to similar rarefaction (in proportion to the occurrence of which, I could suffer an escape of so much as would be requisite to prevent explosion), but, *being what it was*, would, at all events, continue specifically lighter than any compound whatever of mere nitrogen and oxygen. Thus there was a chance—in fact, there was a strong probability—that, *at no epoch of my ascent, I should reach a point where the united weights of my immense balloon, the inconceivably rare gas within it, the car, and its contents, should equal the weight of the mass of the surrounding atmosphere displaced;* and this will be readily understood as the sole condition upon which my upward flight would be arrested. But, if this point were even attained, I could dispense with ballast and other weight to the amount of nearly 300 pounds. In the mean time, the force of gravitation would be constantly diminishing in proportion to the squares of the distances, and so, with a velocity prodigiously accelerating, I should at length arrive in those distant regions where the force of the earth's attraction would be superseded by that of the moon.

There was another difficulty, however, which occasioned me some little disquietude. It has been observed, that, in balloon ascensions to any considerable height, besides the pain attending respiration, great uneasiness is experienced about the head and body, often accompanied with bleeding at the nose, and other symptoms of an alarming kind, and growing more and more inconvenient in proportion to the altitude attained.† This was

* The zodiacal light is probably what the ancients called *Trabes*. *Emicant Trabes quos docos vocant.* Pliny, lib. 2, p. 26.

† Since the original publication of Hans Pfaall, I find that Mr. Green, of Nassau balloon notoriety, and other late aeronauts, deny the assertions of Humboldt, in this respect, and speak of a *decreasing* inconvenience—precisely in accordance with the theory here urged.

a reflection of a nature somewhat startling. Was it not probable that these symptoms would increase until terminated by death itself? I finally thought not. Their origin was to be looked for in the progressive removal of the *customary* atmospheric pressure upon the surface of the body, and consequent distention of the superficial blood-vessels—not in any positive disorganisation of the animal system, as in the case of difficulty in breathing, where the atmospheric density is *chemically insufficient* for the due renovation of blood in a ventricle of the heart. Unless for default of this renovation, I could see no reason, therefore, why life could not be sustained even in a *vacuum*; for the expansion and compression of chest, commonly called breathing, is action purely muscular, and the *cause*, not the *effect*, of respiration. In a word, I conceived that, as the body should become habituated to the want of atmospheric pressure, these sensations of pain would gradually diminish; and, to endure them while they continued, I relied with confidence upon the iron hardihood of my constitution.

Thus, may it please your Excellencies, I have detailed some, though by no means all, the considerations which led me to form the project of a lunar voyage. I shall now proceed to lay before you the result of an attempt so apparently audacious in conception, and, at all events, so utterly unparalleled in the annals of mankind.

Having attained the altitude before mentioned—that is to say, three miles and three quarters—I threw out from the car a quantity of feathers, and found that I still ascended with sufficient rapidity; there was, therefore, no necessity for discharging any ballast. I was glad of this, for I wished to retain with me as much weight as I could carry, for the obvious reason that I could not be *positive* either about the gravitation or the atmospheric density of the moon. I as yet suffered no bodily inconvenience, breathing with great freedom, and feeling no pain whatever in the head. The cat was lying very demurely upon my coat, which I had taken off, and eyeing the pigeons with an air of *nonchalance*. These latter being tied by the leg, to prevent their escape, were busily employed in picking up some grains of rice scattered for them in the bottom of the car.

At twenty minutes past six o'clock, the barometer showed an elevation of 26,400 feet, or five miles to a fraction. The prospect seemed unbounded. Indeed, it is very easily calculated, by means of spherical geometry, how great an extent of the earth's area I beheld. The convex surface of any segment of a sphere is, to the entire surface of the sphere itself, as the versed sine of the segment to the diameter of the sphere. Now, in my case, the versed sine—that is to say, the *thickness* of the segment beneath me—was about equal to my elevation, or the elevation of the point of sight above the surface. "As five miles, then, to eight thousand," would express the proportion of the earth's area seen by me. In other words, I beheld as much as a sixteen-hundredth part of the whole surface of the globe. The sea appeared unruffled as a mirror, although, by means of the telescope, I could perceive it to be in a state of violent agitation. The ship was no longer visible, having drifted away, apparently, to the eastward. I now began to experience, at intervals, severe pain in the head, especially about the ears—still, however, breathing with tolerable freedom. The cat and pigeons seemed to suffer no inconvenience whatever.

At twenty minutes before seven, the balloon entered a long series of dense cloud, which put me to great trouble, by damaging my condensing-apparatus, and wetting me to the skin. This was, to be sure, a singular *rencontre*, for I had not believed it possible that a cloud of this nature could be sustained at so great an elevation. I thought it best, however, to throw out two five-pound pieces of ballast, reserving still a weight of one hundred and sixty-five pounds. Upon so doing I soon rose above the difficulty, and perceived immediately that I had obtained a great increase in my rate of ascent. In a few seconds after my leaving the cloud, a flash of vivid lightning shot from one end of it to the other, and caused it to kindle up, throughout its vast extent, like a mass of ignited charcoal. This, it must be remembered, was in the broad light of day. No fancy may picture the sublimity which might have been exhibited by a similar phenomenon taking place during the darkness of the night. Hell itself might then have found a fitting image. Even as it was, my hair stood on end, while I gazed afar down within the yawning abysses, letting imagination descend, and stalk about in the strange vaulted halls, and ruddy gulfs, and red ghastly chasms of the hideous and unfathomable fire. I had indeed made a narrow escape. Had the balloon remained a very short time longer within the cloud—that is to say, had not the inconvenience of getting wet determined me to discharge the ballast—my destruction might, and probably would, have been the consequence. Such perils, although little considered, are perhaps the greatest which must be encountered in balloons. I had by this time, however, attained too great an elevation to be any longer uneasy on this head.

I was now rising rapidly, and by seven o'clock the barometer indicated an altitude of no less than nine miles

and a half. I began to find great difficulty in drawing my breath. My head, too, was excessively painful; and, having felt for some time a moisture about my cheeks, I at length discovered it to be blood, which was oozing quite fast from the drums of my ears. My eyes, also, gave me great uneasiness. Upon passing the hand over them they seemed to have protruded from their sockets in no inconsiderable degree; and all objects in the car, and even the balloon itself, appeared distorted to my vision. These symptoms were more than I had expected, and occasioned me some alarm. At this juncture, very imprudently, and without consideration, I threw out from the car three five-pound pieces of ballast. The accelerated rate of ascent thus obtained carried me too rapidly, and without sufficient gradation, into a highly rarefied stratum of the atmosphere, and the result had nearly proved fatal to my expedition and to myself. I was suddenly seized with a spasm which lasted for more than five minutes, and even when this, in a measure, ceased, I could catch my breath only at long intervals, and in a gasping manner—bleeding all the while copiously at the nose and ears, and even slightly at the eyes. The pigeons, appearing distressed in the extreme, struggled to escape, while the cat mewed piteously, and, with her tongue hanging out of her mouth, staggered to and fro in the car as if under the influence of poison. I now, too late, discovered the great rashness of which I had been guilty in discharging the ballast, and my agitation was excessive. I anticipated nothing less than death, and death in a few minutes. The physical suffering I underwent contributed also to render me nearly incapable of making any exertion for the preservation of my life. I had, indeed, little power of reflection left, and the violence of the pain in my head seemed to be greatly on the increase. Thus I found that my senses would shortly give way altogether, and I had already clutched one of the valve-ropes with the view of attempting a descent, when the recollection of the trick I had played the three creditors, and the possible consequences to myself should I return, operated to deter me for the moment. I lay down in the bottom of the car, and endeavoured to collect my faculties. In this I so far succeeded as to determine upon the experiment of losing blood. Having no lancet, however, I was constrained to perform the operation in the best manner I was able, and finally succeeded in opening a vein in my left arm, with the blade of my penknife. The blood had hardly commenced flowing when I experienced a sensible relief, and by the time I had lost about half a moderate basinful, most of the worst symptoms had abandoned me entirely. I nevertheless did not think it expedient to attempt getting on my feet immediately; but, having tied up my arm as well as I could, I lay still for about a quarter of an hour. At the end of this time I arose, and found myself freer from absolute *pain* of any kind than I had been during the last hour and a quarter of my ascension. The difficulty of breathing, however, was diminished in a very slight degree, and I found that it would soon be positively necessary to make use of my condenser. In the mean time, looking towards the cat, who was again snugly stowed away upon my coat, I discovered, to my infinite surprise, that she had taken the opportunity of my indisposition to bring into light a litter of three little kittens. This was an addition to the number of passengers on my part altogether unexpected; but I was pleased at the occurrence. It would afford me a chance of bringing to a kind of test the truth of a surmise which more than anything else had influenced me in attempting this ascension. I had imagined that the *habitual* endurance of the atmospheric pressure at the surface of the earth was the cause, or nearly so, of the pain attending animal existence at a distance above the surface. Should the kittens be found to suffer uneasiness *in an equal degree with their mother*, I must consider my theory in fault, but a failure to do so I should look upon as a strong confirmation of my idea.

By eight o'clock I had actually attained an elevation of seventeen miles above the surface of the earth. Thus it seemed to me evident that my rate of ascent was not only on the increase, but that the progression would have been apparent in a slight degree even had I not discharged the ballast which I did. The pains in my head and ears returned at intervals with violence, and I still continued to bleed occasionally at the nose; but, upon the whole, I suffered much less than might have been expected. I breathed, however, at every moment with more and more difficulty, and each exhalation was attended with a troublesome spasmodic action of the chest. I now unpacked the condensing-apparatus, and got it ready for immediate use.

The view of the earth, at this period of my ascension, was beautiful indeed. To the westward, the northward, and the southward, as far as I could see, lay a boundless sheet of apparently unruffled ocean, which every moment gained a deeper and deeper tint of blue. At a vast distance to the eastward, although perfectly discernible, extended the islands of Great Britain, the entire Atlantic coasts of France and Spain, with a small portion of the northern part of the continent of Africa. Of individual edifices not a trace could be discovered, and the proudest cities of mankind had utterly faded away from the face of the earth.

What mainly astonished me, in the appearance of things below, was the seeming concavity of the surface of

the globe. I had, thoughtlessly enough, expected to see its real *convexity* become evident as I ascended; but a very little reflection sufficed to explain the discrepancy. A line, dropped from my position perpendicularly to the earth, would have formed the perpendicular of a right-angled triangle, of which the base would have extended from the right angle to the horizon, and the hypothenuse from the horizon to my position. But my height was little or nothing in comparison with my prospect. In other words, the base and hypothenuse of the supposed triangle would, in my case, have been so long, when compared to the perpendicular, that the two former might have been regarded as nearly parallel. In this manner the horizon of the aeronaut appears always to be *upon a level* with the car. But as the point immediately beneath him seems, and is, at a great distance below him, it seems, of course, also at a great distance below the horizon. Hence the impression of concavity; and this impression must remain until the elevation shall bear so great a proportion to the prospect that the apparent parallelism of the base and hypothenuse disappears.

The pigeons about this time seeming to undergo much suffering, I determined upon giving them their liberty. I first untied one of them, a beautiful grey-mottled pigeon, and placed him upon the rim of the wickerwork. He appeared extremely uneasy, looking anxiously around him, fluttering his wings, and making a loud cooing noise, but could not be persuaded to trust himself from the car. I took him up at last, and threw him to about half-a-dozen yards from the balloon. He made, however, no attempt to descend, as I had expected, but struggled with great vehemence to get back, uttering at the same time very shrill and piercing cries. He at length succeeded in regaining his former station on the rim, but had hardly done so when his head dropped upon his breast, and he fell dead within the car. The other one did not prove so unfortunate. To prevent his following the example of his companion, and accomplishing a return, I threw him downwards with all my force, and was pleased to find him continue his descent with great velocity, making use of his wings with ease, and in a perfectly natural manner. In a very short time he was out of sight, and I have no doubt he reached home in safety. Puss, who seemed in a great measure recovered from her illness, now made a hearty meal of the dead bird, and then went to sleep with much apparent satisfaction. Her kittens were quite lively, and so far evinced not the slightest sign of any uneasiness.

At a quarter past eight, being able no longer to draw breath without the most intolerable pain, I proceeded forthwith to adjust around the car the apparatus belonging to the condenser. This apparatus will require some little explanation, and your Excellencies will please to bear in mind that my object, in the first place, was to surround myself and car entirely with a barricade against the highly-rarefied atmosphere in which I was existing, with the intention of introducing within this barricade, by means of my condenser, a quantity of this same atmosphere sufficiently condensed for the purposes of respiration. With this object in view, I had prepared a very strong, perfectly air-tight, but flexible gum-elastic bag. In this bag, which was of sufficient dimensions, the entire car was in a manner placed. That is to say, it (the bag) was drawn over the whole bottom of the car, up its sides, and so on, along the outside of the ropes, to the upper rim, or hoop, where the network is attached. Having pulled the bag up in this way, and formed a complete enclosure on all sides, and at bottom, it was now necessary to fasten up its top, or mouth, by passing its material over the hoop of the network—in other words, between the network and the hoop. But if the network were separated from the hoop to admit this passage, what was to sustain the car in the mean time? Now, the network was not permanently fastened to the hoop, but attached by a series of running loops or nooses. I therefore undid only a few of these loops at one time, leaving the car suspended by the remainder. Having thus inserted a portion of the cloth forming the upper part of the bag, I refastened the loops—not to the hoop, for that would have been impossible, since the cloth now intervened—but to a series of large buttons, affixed to the cloth itself, about three feet below the mouth of the bag; the intervals between the buttons having been made to correspond to the intervals between the loops. This done, a few more of the loops were fastened from the rim, a further portion of the cloth introduced, and the disengaged loops then connected with their proper buttons. In this way it was possible to insert the whole upper part of the bag between the network and the hoop. It is evident that the hoop would now drop down within the car, while the whole weight of the car itself, with all its contents, would be held up merely by the strength of the buttons. This, at first sight, would seem an inadequate dependence; but it was by no means so, for the buttons were not only very strong in themselves, but so close together that a very slight portion of the whole weight was supported by any one of them. Indeed, had the car and contents been three times heavier than they were, I should not have been at all uneasy. I now raised up the hoop again within the covering of gum-elastic, and propped it at nearly its former

height by means of three light poles prepared for the occasion. This was done, of course, to keep the bag distended at the top, and to preserve the lower part of the network in its proper situation. All that now remained was to fasten up the mouth of the enclosure; and this was readily accomplished by gathering the folds of the material together, and twisting them up very tightly on the inside by means of a kind of stationary *tourniquet*.

In the sides of the covering thus adjusted round the car had been inserted three circular panes of thick but clear glass, through which I could see without difficulty around me in every horizontal direction. In that portion of the cloth forming the bottom was likewise a fourth window of the same kind, and corresponding with a small aperture in the floor of the car itself. This enabled me to see perpendicularly down, but having found it impossible to place any similar contrivance overhead, on account of the peculiar manner of closing up the opening there, and the consequent wrinkles in the cloth, I could expect to see no objects situated directly in my zenith. This, of course, was a matter of little consequence; for, had I even been able to place a window at top, the balloon itself would have prevented my making any use of it.

About a foot below one of the side windows was a circular opening three inches in diameter, and fitted with a brass rim adapted in its inner edge to the windings of a screw. In this rim was screwed the large tube of the condenser, the body of the machine being, of course, within the chamber of gum-elastic. Through this tube a quantity of the rare atmosphere circumjacent being drawn by means of a *vacuum* created in the body of the machine, was thence discharged, in a state of condensation, to mingle with the thin air already in the chamber. This operation, being repeated several times, at length filled the chamber with atmosphere proper for all the purposes of respiration. But, in so confined a space, it would in a short time necessarily become foul and unfit for use from frequent contact with the lungs. It was then ejected by a small valve at the bottom of the car, the dense air readily sinking into the thinner atmosphere below. To avoid the inconvenience of making a total *vacuum* at any moment within the chamber this purification was never accomplished all at once, but in a gradual manner; the valve being opened only for a few seconds, then closed again, until one or two strokes from the pump of the condenser had supplied the place of the atmosphere ejected. For the sake of experiment I had put the cat and kittens in a small basket, and suspended it outside the car to a button at the bottom, close to the valve, through which I could feed them at any moment when necessary. I did this at some little risk, and before closing the mouth of the chamber, by reaching under the car with one of the poles before mentioned, to which a hook had been attached. As soon as dense air was admitted in the chamber, the hoop and poles became unnecessary; the expansion of the enclosed atmosphere powerfully distending the gum-elastic.

By the time I had fully completed these arrangements, and filled the chamber as explained, it wanted only ten minutes of nine o'clock. During the whole period of my being thus employed, I endured the most terrible distress from difficulty of respiration; and bitterly did I repent the negligence, or rather fool-hardiness, of which I had been guilty, in putting off to the last moment a matter of so much importance. But, having at length accomplished it, I soon began to reap the benefit of my invention. Once again I breathed with perfect freedom and ease; and, indeed, why should I not? I was also agreeably surprised to find myself in a great measure relieved from the violent pains which had hitherto tormented me. A slight headache, accompanied with a sensation of fulness or distension about the wrists, the ankles, and the throat, was nearly all of which I had now to complain. Thus it seemed evident that a greater part of the uneasiness attending the removal of atmospheric pressure had actually worn off, as I had expected, and that much of the pain endured for the last two hours should have been attributed altogether to the effects of a deficient respiration.

At twenty minutes before nine o'clock—that is to say, a short time prior to my closing up the mouth of the chamber—the mercury attained its limits, or ran down in the barometer, which, as I mentioned before, was one of an extended construction. It then indicated an altitude on my part of 132,000 feet, or five-and-twenty miles; and I consequently surveyed at that time an extent of the earth's area amounting to no less than the three-hundred-and-twentieth part of its entire superficies. At nine o'clock I had again lost sight of land to the eastward, but not before I became aware that the balloon was drifting rapidly to the N.N.W. The ocean beneath me still retained its apparent concavity, although my view was often interrupted by the masses of cloud which floated to and fro.

At half-past nine I tried the experiment of throwing out a handful of feathers through the valve. They did not float as I had expected; but dropped down perpendicularly, like a bullet, *en masse*, and with the greatest velocity—being out of sight in a very few seconds. I did not at first know what to make of this extraordinary

phenomenon; not being able to believe that my rate of ascent had, of a sudden, met with so prodigious an acceleration. But it soon occurred to me that the atmosphere was now far too rare to sustain even the feathers; that they actually fell, as they appeared to do, with great rapidity; and that I had been surprised by the united velocities of their descent and my own elevation.

By ten o'clock I found that I had very little to occupy my immediate attention. Affairs went on swimmingly, and I believed the balloon to be going upwards with a speed increasing momently, although I had no longer any means of ascertaining the progression of the increase. I suffered no pain or uneasiness of any kind, and enjoyed better spirits than I had at any period since my departure from Rotterdam; busying myself now in examining the state of my various apparatus, and now in regenerating the atmosphere within the chamber. This latter point I determined to attend to at regular intervals of forty minutes, more on account of the preservation of my health than from so frequent a renovation being absolutely necessary. In the mean while I could not help making anticipations. Fancy revelled in the wild and dreamy regions of the moon. Imagination, feeling herself for once unshackled, roamed at will among the ever-changing wonders of a shadowy and unstable land. Now there were hoary and time-honoured forests, and craggy precipices, and waterfalls tumbling with a loud noise into abysses without a bottom. Then I came suddenly into still noonday solitudes, where no wind of heaven ever intruded, and where vast meadows of poppies, and slender, lily-looking flowers spread themselves out a weary distance, all silent and motionless for ever. Then again I journeyed far down away into another country where it was all one dim and vague lake, with a boundary-line of clouds. But fancies such as these were not the sole possessors of my brain. Horrors of a nature most stern and most appalling would too frequently obtrude themselves upon my mind, and shake the innermost depths of my soul with the bare supposition of their possibility. Yet I would not suffer my thoughts for any length of time to dwell upon these latter speculations, rightly judging the real and palpable dangers of the voyage sufficient for my undivided attention.

At five o'clock, P.M., being engaged in regenerating the atmosphere within the chamber, I took that opportunity of observing the cat and kittens through the valve. The cat herself appeared to suffer again very much, and I had no hesitation in attributing her uneasiness chiefly to a difficulty in breathing; but my experiment with the kittens had resulted very strangely. I had expected, of course, to see them betray a sense of pain, although in a less degree than their mother; and this would have been sufficient to confirm my opinion concerning the habitual endurance of atmospheric pressure. But I was not prepared to find them, upon close examination, evidently enjoying a high degree of health, breathing with the greatest ease and perfect regularity, and evincing not the slightest sign of any uneasiness. I could only account for all this by extending my theory, and supposing that the highly rarefied atmosphere around might perhaps not be, as I had taken for granted, chemically insufficient for the purposes of life, and that a person born in such a *medium* might possibly be unaware of any inconvenience attending its inhalation, while, upon removal to the denser *strata* near the earth, he might endure tortures of a similar nature to those I had so lately experienced. It has since been to me a matter of deep regret that an awkward accident at this time occasioned me the loss of my little family of cats, and deprived me of the insight into this matter which a continued experiment might have afforded. In passing my hand through the valve, with a cup of water for the old puss, the sleeve of my shirt became entangled in the loop which sustained the basket, and thus in a moment loosened it from the button. Had the whole actually vanished into air, it could not have shot from my sight in a more abrupt and instantaneous manner. Positively there could not have intervened the tenth part of a second between the disengagement of the basket and its absolute disappearance with all that it contained. My good wishes followed it to the earth, but of course I had no hope that either cat or kittens would live to tell the tale.

At six o'clock I perceived a great portion of the earth's visible area to the eastward involved in thick shadow, which continued to advance with great rapidity, until, at five minutes before seven, the whole surface in view was enveloped in the darkness of night. It was not, however, until long after this time that the rays of the setting sun ceased to illumine the balloon; and this circumstance, although of course fully anticipated, did not fail to give me an infinite deal of pleasure. It was evident that, in the morning, I should behold the rising luminary many hours at least before the citizens of Rotterdam, in spite of their situation so much farther to the eastward, and thus, day after day, in proportion to the height ascended, would I enjoy the light of the sun for a longer and a longer period. I now determined to keep a journal of my passage, reckoning the days from one to twenty-four hours continuously, without taking into consideration the intervals of darkness.

At ten o'clock, feeling sleepy, I determined to lie down for the rest of the night; but here a difficulty presented

itself, which, obvious as it may appear, had escaped my attention up to the very moment of which I am now speaking. If I went to sleep as I proposed, how could the atmosphere in the chamber be regenerated in the *interim*? To breathe it for more than an hour at the furthest would be a matter of impossibility; or, even if this term could be extended to an hour and a quarter, the most ruinous consequences might ensue. The consideration of this dilemma gave me no little disquietude; and it will hardly be believed that, after the dangers I had undergone, I should look upon this business in so serious a light as to give up all hope of accomplishing my ultimate design, and finally make up my mind to the necessity of a descent; but this hesitation was only momentary. I reflected that man is the veriest slave of custom, and that many points in the routine of his existence are deemed *essentially* important which are only so *at all* by his having rendered them habitual. It was very certain that I could not do without sleep; but I might easily bring myself to feel no inconvenience from being awakened at intervals of an hour during the whole period of my repose. It would require but five minutes at most to regenerate the atmosphere in the fullest manner; and the only real difficulty was to contrive a method of arousing myself at the proper moment for so doing. But this was a question which, I am willing to confess, occasioned me no little trouble in its solution. To be sure, I had heard of the student who, to prevent his falling asleep over his books, held in one hand a ball of copper, the din of whose descent into a basin of the same metal on the floor beside his chair served effectually to startle him up, if at any moment he should be overcome with drowsiness. My own case, however, was very different indeed, and left me no room for any similar idea; for I did not wish to keep awake, but to be aroused from slumber at regular intervals of time. I at length hit upon the following expedient, which, simple as it may seem, was hailed by me, at the moment of discovery, as an invention fully equal to that of the telescope, the steam-engine, or the art of printing itself.

It is necessary to premise that the balloon, at the elevation now attained, continued its course upwards with an even and undeviating ascent, and the car consequently followed with a steadiness so perfect that it would have been impossible to detect in it the slightest vacillation. This circumstance favoured me greatly in the project I now determined to adopt. My supply of water had been put on board in kegs containing five gallons each, and ranged very securely around the interior of the car. I unfastened one of these, and taking two ropes, tied them tightly across the rim of the wickerwork from one side to the other, placing them about a foot apart and parallel, so as to form a kind of shelf, upon which I placed the keg, and steadied it in a horizontal position. About eight inches immediately below these ropes, and four feet from the bottom of the car, I fastened another shelf, but made of thin plank, being the only similar piece of wood I had. Upon this latter shelf, and exactly beneath one of the rims of the keg, a small earthen pitcher was deposited. I now bored a hole in the end of the keg over the pitcher, and fitted in a plug of soft wood, cut in a tapering or conical shape. This plug I pushed in or pulled out, as might happen, until, after a few experiments, it arrived at that exact degree of tightness at which the water, oozing from the hole, and falling into the pitcher below, would fill the latter to the brim in the period of sixty minutes. This, of course, was a matter briefly and easily ascertained, by noticing the proportion of the pitcher filled in any given time. Having arranged all this, the rest of the plan is obvious. My bed was so contrived upon the floor of the car as to bring my head, in lying down, immediately below the mouth of the pitcher. It was evident that, at the expiration of an hour, the pitcher, getting full, would be forced to run over, and to run over at the mouth, which was somewhat lower than the rim. It was also evident that the water, thus falling from a height of more than four feet, could not do otherwise than fall upon my face, and that the sure consequence would be to waken me up instantaneously, even from the soundest slumber in the world.

It was fully eleven by the time I had completed these arrangements, and I immediately betook myself to bed, with full confidence in the efficiency of my invention. Nor in this matter was I disappointed. Punctually every sixty minutes was I aroused by my trusty chronometer, when, having emptied the pitcher into the bunghole of the keg, and performed the duties of the condenser, I retired again to bed. These regular interruptions to my slumber caused me even less discomfort than I had anticipated; and when I finally arose for the day it was seven o'clock, and the sun had already attained many degrees above the line of my horizon.

*April 3rd.*—I found the balloon at an immense height indeed, and the earth's convexity had now become strikingly manifest. Below me in the ocean lay a cluster of black specks, which undoubtedly were islands. Overhead, the sky was of a jetty black, and the stars were brilliantly visible; indeed they had been so constantly since the first day of ascent. Far away to the northward I perceived a thin, white, and exceedingly brilliant line, or streak, on the edge of the horizon, and I had no hesitation in supposing it to be the southern disc of the

ices of the Polar Sea. My curiosity was greatly excited, for I had hopes of passing on much farther to the north, and might possibly, at some period, find myself placed directly above the Pole itself. I now lamented that my great elevation would, in this case, prevent my taking as accurate a survey as I could wish. Much, however, might be ascertained.

Nothing else of an extraordinary nature occurred during the day. My apparatus all continued in good order, and the balloon still ascended without any perceptible vacillation. The cold was intense, and obliged me to wrap up closely in an overcoat. When darkness came over the earth, I betook myself to bed, although it was for many hours afterwards broad daylight all around my immediate situation. The water-clock was punctual in its duty, and I slept until next morning soundly, with the exception of the periodical interruption.

*April 4th.*—Arose in good health and spirits, and was astonished at the singular change which had taken place in the appearance of the sea. It had lost in a great measure the deep tint of blue it had hitherto worn, being now of a greyish-white, and of a lustre dazzling to the eye. The convexity of the ocean had become so evident, that the entire mass of the distant water seemed to be tumbling headlong over the abyss of the horizon, and I found myself listening on tiptoe for the echoes of the mighty cataract. The islands were no longer visible; whether they had passed down the horizon to the south-east, or whether my increasing elevation had left them out of sight, it is impossible to say. I was inclined, however, to the latter opinion. The rim of ice to the northward was growing more and more apparent. Cold by no means so intense. Nothing of importance occurred, and I passed the day in reading, having taken care to supply myself with books.

*April 5th.*—Beheld the singular phenomenon of the sun rising while nearly the whole visible surface of the earth continued to be involved in darkness. In time, however, the light spread itself over all, and I again saw the line of ice to the northward. It was now very distinct, and appeared of a much darker hue than the waters of the ocean. I was evidently approaching it, and with great rapidity. Fancied I could again distinguish a strip of land to the eastward, and one also to the westward, but could not be certain. Weather moderate. Nothing of any consequence happened during the day. Went early to bed.

*April 6th.*—Was surprised at finding the rim of ice at a very moderate distance, and an immense field of the same material stretching away off to the horizon in the north. It was evident that if the balloon held its present course it would soon arrive above the Frozen Ocean, and I had now little doubt of ultimately seeing the Pole. During the whole of the day I continued to near the ice. Towards night the limits of my horizon very suddenly and materially increased, owing undoubtedly to the earth's form being that of an oblate spheroid, and my arriving above the flattened regions in the vicinity of the Arctic circle. When darkness at length overtook me, I went to bed in great anxiety, fearing to pass over the object of so much curiosity when I should have no opportunity of observing it.

*April 7th.*—Arose early, and, to my great joy, at length beheld what there could be no hesitation in supposing the northern Pole itself. It was there, beyond a doubt, and immediately beneath my feet; but, alas! I had now ascended to so vast a distance that nothing could with accuracy be discerned. Indeed, to judge from the progression of the numbers indicating my various altitudes, respectively, at different periods, between six A.M. on the 2nd of April, and twenty minutes before nine A.M. of the same day (at which time the barometer ran down), it might be fairly inferred that the balloon had now, at four o'clock in the morning of April the 7th, reached a height of *not* less certainly than 7254 miles above the surface of the sea. This elevation may appear immense; but the estimate upon which it is calculated gave a result in all probability far inferior to the truth. At all events, I undoubtedly beheld the whole of the earth's major diameter; the entire northern hemisphere lay beneath me like a chart orthographically projected; and the great circle of the equator itself formed the boundary-line of my horizon. Your Excellencies may, however, readily imagine that the confined regions hitherto unexplored within the limits of the Arctic circle, although situated directly beneath me, and therefore seen without any appearance of being foreshortened, were still in themselves comparatively too diminutive, and at too great a distance from the point of sight, to admit of any very accurate examination. Nevertheless, what could be seen was of a nature singular and exciting. Northwardly from that huge rim before mentioned, and which, with slight qualification, may be called the limit of human discovery in these regions, one unbroken, or nearly unbroken, sheet of ice continues to extend. In the first few degrees of this its progress, its surface is very sensibly flattened, farther on depressed into a plane, and finally, becoming *not a little concave*, it terminates, at the Pole itself, in a circular centre, sharply defined, whose apparent diameter subtended at the balloon an angle of about sixty-five seconds, and whose dusky hue, varying in

intensity, was at all times darker than any other spot upon the visible hemisphere, and occasionally deepened into the most absolute blackness. Farther than this little could be ascertained. By twelve o'clock the circular centre had materially decreased in circumference, and by seven P.M. I lost sight of it entirely; the balloon passing over the western limb of the ice, and floating away rapidly in the direction of the equator.

*April 8th.*—Found a sensible diminution in the earth's apparent diameter, besides a material alteration in its general colour and appearance. The whole visible area partook in different degrees of a tint of pale yellow, and in some portions had acquired a brilliancy even painful to the eye. My view downwards was also considerably impeded by the dense atmosphere in the vicinity of the surface being loaded with clouds, between whose masses I could only now and then obtain a glimpse of the earth itself. This difficulty of direct vision had troubled me more or less for the last forty-eight hours; but my present enormous elevation, brought closer together, as it were, the floating bodies of vapour, and the inconvenience became, of course, more and more palpable in proportion to my ascent. Nevertheless, I could easily perceive that the balloon now hovered above the range of great lakes in the continent of North America, and was holding a course due south, which would soon bring me to the tropics. This circumstance did not fail to give me the most heartfelt satisfaction, and I hailed it as a happy omen of ultimate success. Indeed, the direction I had hitherto taken had filled me with uneasiness; for it was evident that, had I continued it much longer, there would have been no possibility of my arriving at the moon at all, whose orbit is inclined to the ecliptic at only the small angle of 5 degrees, 8 minutes, 48 seconds. Strange as it may seem, it was only at this late period that I began to understand the great error I had committed in not taking my departure from earth at some point *in the plane of the lunar ellipse.*

*April 9th.*—To-day the earth's diameter was greatly diminished, and the colour of the surface assumed hourly a deeper tint of yellow. The balloon kept steadily on her course to the southward, and arrived at nine P.M. over the northern edge of the Mexican Gulf.

*April 10th.*—I was suddenly aroused from slumber, about five o'clock this morning, by a loud, crackling, and terrific sound, for which I could in no manner account. It was of very brief duration, but, while it lasted, resembled nothing in the world of which I had any previous experience. It is needless to say that I became excessively alarmed, having, in the first instance, attributed the noise to the bursting of the balloon. I examined all my apparatus, however, with great attention, and could discover nothing out of order. Spent a great part of the day in meditating upon an occurrence so extraordinary, but could find no means whatever of accounting for it. Went to bed dissatisfied, and in a state of great anxiety and agitation.

*April 11th.*—Found a startling diminution in the apparent diameter of the earth, and a considerable increase, now observable for the first time, in that of the moon itself, which wanted only a few days of being full. It now required long and excessive labour to condense within the chamber sufficient atmospheric air for the sustenance of life.

*April 12th.*—A singular alteration took place in regard to the direction of the balloon, and, although fully anticipated, afforded me the most unequivocal delight. Having reached, in its former course, about the twentieth parallel of southern latitude, it turned off suddenly, at an acute angle, to the eastward, and thus proceeded throughout the day, keeping nearly, if not altogether, *in the exact plane of the lunar ellipse.* What was worthy of remark, a very perceptible vacillation in the car was a consequence of this change of route—a vacillation which prevailed, in a more or less degree, for a period of many hours.

*April 13th.*—Was again very much alarmed by a repetition of the loud crackling noise which terrified me on the tenth. Thought long upon the subject, but was unable to form any satisfactory conclusion. Great decrease in the earth's apparent diameter, which now subtended from the balloon an angle of very little more than twenty-five degrees. The moon could not be seen at all, being nearly in my zenith. I still continued in the plane of the ellipse, but made little progress to the eastward.

*April 14th.*—Extremely rapid decrease in the diameter of the earth. To-day I became strongly impressed with the idea that the balloon was now actually running up the line of apsides to the point of perigee—in other words, holding the direct course which would bring it immediately to the moon in that part of its orbit the nearest to the earth. The moon itself was directly overhead, and consequently hidden from my view. Great and long-continued labour necessary for the condensation of the atmosphere.

*April 15th.*—Not even the outlines of continents and seas could now be traced upon the earth with distinctness. About twelve o'clock I became aware, for the third time, of that appalling sound which had astonished me

before. It now, however, continued for some moments, and gathered intensity as it continued. At length, while stupified and terror-stricken, I stood in expectation of I knew not what hideous destruction, the car vibrated with excessive violence, and a gigantic and flaming mass of some material which I could not distinguish came with a voice of a thousand thunders, roaring and booming by the balloon. When my fears and astonishment had in some degree subsided, I had little difficulty in supposing it to be some mighty volcanic fragment ejected from that world to which I was so rapidly approaching, and, in all probability, one of that singular class of substances occasionally picked up on the earth, and termed meteoric stones for want of a better appellation.

*April 16th.*—To-day, looking upwards as well as I could, through each of the side-windows alternately, I beheld, to my great delight, a very small portion of the moon's disk protruding, as it were, on all sides beyond the huge circumference of the balloon. My agitation was extreme, for I had now little doubt of soon reaching the end of my perilous voyage. Indeed, the labour now required by the condenser had increased to a most oppressive degree, and allowed me scarcely any respite from exertion. Sleep was a matter nearly out of the question. I became quite ill, and my frame trembled with exhaustion. It was impossible that human nature could endure this state of intense suffering much longer. During the now brief interval of darkness a meteoric stone again passed in my vicinity, and the frequency of these phenomena began to occasion me much apprehension.

*April 17th.*—This morning proved an epoch in my voyage. It will be remembered that on the thirteenth the earth subtended an angular breadth of twenty-five degrees. On the fourteenth this had greatly diminished; on the fifteenth a still more rapid decrease was observable; and on retiring for the night of the sixteenth, I had noticed an angle of no more than about seven degrees and fifteen minutes. What therefore must have been my amazement, on awakening from a brief and disturbed slumber, on the morning of this day, the seventeenth, at finding the surface beneath me so suddenly and wonderfully *augmented* in volume, as to subtend no less than thirty-nine degrees in apparent angular diameter! I was thunderstruck! No words can give any adequate idea of the extreme, the absolute horror and astonishment with which I was seized, possessed, and altogether overwhelmed. My knees tottered beneath me—my teeth chattered—my hair started up on end. "The balloon, then, had actually burst!" These were the first tumultuous ideas which hurried through my mind: "The balloon had positively burst!—I was falling—falling with the most impetuous, the most unparalleled velocity! To judge from the immense distance already so quickly passed over, it could not be more than ten minutes at furthest before I should meet the surface of the earth, and be hurled into annihilation!" But at length reflection came to my relief. I paused—I considered—and I began to doubt. The matter was impossible. I could not in any reason have so rapidly come down. Besides, although I was evidently approaching the surface below me, it was with a speed by no means commensurate with the velocity I had at first conceived. This consideration served to calm the perturbation of my mind, and I finally succeeded in regarding the phenomenon in its proper point of view. In fact, amazement must have fairly deprived me of my senses, when I could not see the vast difference in appearance between the surface below me and the surface of my mother earth. The latter was indeed over my head, and completely hidden by the balloon, while the moon—the moon itself in all its glory—lay beneath me, and at my feet.

The stupor and surprise produced in my mind by this extraordinary change in the posture of affairs, was perhaps, after all, that part of the adventure least susceptible of explanation. For the *bouleversement* in itself was not only natural and inevitable, but had been long actually anticipated, as a circumstance to be expected whenever I should arrive at the exact point of my voyage where the attraction of the planet should be superseded by the attraction of the satellite—or, more precisely, where the gravitation of the balloon towards the earth should be less powerful than its gravitation towards the moon. To be sure, I rose from a sound slumber, with all my senses in confusion, to the contemplation of a very startling phenomenon, and one which, although expected, was not expected at the moment. The revolution itself must of course have taken place in an easy and gradual manner, and it is by no means clear that, had I even been awake at the time of the occurrence, I should have been made aware of it by any *internal* evidence of an inversion—that is to say, by any inconvenience or disarrangement either about my person or about my apparatus.

It is almost needless to say that, upon coming to a due sense of my situation, and emerging from the terror which had absorbed every faculty of my soul, my attention was in the first place wholly directed to the contemplation of the general physical appearance of the moon. It lay beneath me like a chart—and although I judged it to be still at no inconsiderable distance, the indentures of its surface were defined to my vision with a most striking and altogether unaccountable distinctness. The entire absence of ocean or sea, and indeed of any lake or river, or body

of water whatsoever, struck me, at the first glance, as the most extraordinary feature in its geological condition. Yet, strange to say, I beheld vast level regions of a character decidedly alluvial, although by far the greater portion of the hemisphere in sight was covered with innumerable volcanic mountains, conical in shape, and having more the appearance of artificial than of natural protuberances. The highest among them does not exceed three and three-quarter miles in perpendicular elevation; but a map of the volcanic districts of the Campi Phlegræi would afford to your Excellencies a better idea of their general surface than any unworthy description I might think proper to attempt. The greater part of them were in a state of evident eruption, and gave me fearfully to understand their fury and their power, by the repeated thunders of the mis-called meteoric stones, which now rushed upwards by the balloon with a frequency more and more appalling.

*April 18th.*—To-day I found an enormous increase in the moon's apparent bulk, and the evidently accelerated velocity of my descent began to fill me with alarm. It will be remembered that, in the earliest stage of my speculations upon the possibility of a passage to the moon, the existence in its vicinity of an atmosphere dense in proportion to the bulk of the planet had entered largely into my calculations; this, too, in spite of many theories to the contrary, and, it may be added, in spite of a general disbelief in the existence of any lunar atmosphere at all. But in addition to what I have already urged in regard to Encke's comet, and the zodiacal light, I have been strengthened in my opinion by certain observations of M. Schroeter, of Lilienthal. He observed the moon, when two days and a half old, in the evening soon after sunset, before the dark part was visible, and continued to watch it until it became visible. The two cusps appeared tapering in a very sharp faint prolongation, each exhibiting its farthest extremity faintly illuminated by the solar rays, before any part of the dark hemisphere was visible. Soon afterwards, the whole dark limb became illuminated. This prolongation of the cusps beyond the semicircle I thought must have arisen from the refraction of the sun's rays by the moon's atmosphere. I computed also the height of the atmosphere (which could refract light enough in its dark hemisphere to produce a twilight more luminous than the light reflected from the earth when the moon is about 32° from the new) to be 1356 Paris feet; in this view, I supposed the greatest height capable of refracting the solar ray to be 5376 feet. My ideas upon this topic had also received confirmation by a passage in the eighty-second volume of the Philosophical Transactions, in which it is stated that, at an occultation of Jupiter's satellites, the third disappeared after having been about one or two seconds of time indistinct, and the fourth became indiscernible near the limb.*

Upon the resistance, or more properly upon the support, of an atmosphere, existing in the state of density imagined, I had of course entirely depended for the safety of my ultimate descent. Should I then, after all, prove to have been mistaken, I had in consequence nothing better to expect, as a *finale* to my adventure, than being dashed into atoms against the rugged surface of the satellite. And indeed I had now every reason to be terrified. My distance from the moon was comparatively trifling, while the labour required by the condenser was diminished not at all, and I could discover no indication whatever of a decreasing rarity in the air.

*April 19th.*—This morning, to my great joy, about nine o'clock—the surface of the moon being frightfully near, and my apprehensions excited to the utmost—the pump of my condenser gave evident tokens of an alteration in the atmosphere. By ten I had reason to believe its density considerably increased. By eleven very little labour was necessary at the apparatus; and, at twelve o'clock, with some hesitation, I ventured to unscrew the *tourniquet*, when, finding no inconvenience from having done so, I finally threw open the gum-elastic chamber, and unrigged it from around the car. As might have been expected, spasms and violent headache were the immediate consequences of an experiment so precipitate and full of danger. But these and other difficulties attending respiration, as they were by no means so great as to put me in peril of my life, I determined to endure as I best could in consideration of my leaving them behind me momently in my approach to the denser *strata* near the moon. This approach, however, was still impetuous in the extreme; and it soon became alarmingly certain that although I had probably not been deceived in the expectation of an atmosphere dense in proportion to the mass of the satellite, still I had been wrong

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* Hevelius writes that he has several times found in skies perfectly clear, when even stars of the sixth and seventh magnitude were conspicuous, that, at the same altitude of the moon, at the same elongation from the earth, and with one and the same excellent telescope, the moon and its maculæ did not appear equally lucid at all times. From the circumstances of the observation, it is evident that the cause of this phenomenon is not either in our air, in the tube, in the moon, or in the eye of the spectator, but must be looked for in something (an atmosphere?) existing about the moon.

Cassini frequently observed Saturn, Jupiter, and the fixed stars, when approaching the moon to occultation, to have their circular figure changed into an oval one; and, in other occultations, he found no alteration of figure at all. Hence it might be supposed that at some times, and not at others, there is a dense matter encompassing the moon, wherein the rays of the stars are refracted.

in supposing this density, even at the surface, at all adequate to the support of the great weight contained in the car of my balloon. Yet this *should* have been the case, and in an equal degree as at the surface of the earth, the actual gravity of bodies at either planet supposed in the ratio of the atmospheric condensation. That it *was not* the case, however, my precipitous downfall gave testimony enough; *why* it was not so can only be explained by a reference to those possible geological disturbances to which I have formerly alluded. At all events, I was now close upon the planet, and coming down with the most terrible impetuosity. I lost not a moment, accordingly, in throwing overboard first my ballast, then my water-kegs, then my condensing-apparatus and gum-elastic chamber, and finally every article within the car. But it was all to no purpose. I still fell with horrible rapidity, and was now not more than half a mile from the surface. As a last resource, therefore, having got rid of my coat, hat, and boots, I cut loose from the balloon *the car itself*, which was of no inconsiderable weight, and thus, clinging with both hands to the network, I had barely time to observe that the whole country, as far as the eye could reach, was thickly interspersed with diminutive habitations, ere I tumbled headlong into the very heart of a fantastical-looking city, and into the middle of a vast crowd of ugly little people, who none of them uttered a single syllable, or gave themselves the least trouble to render me assistance, but stood, like a parcel of idiots, grinning in a ludicrous manner, and eyeing me and my balloon askant, with their arms set a-kimbo. I turned from them in contempt, and, gazing upwards at the earth so lately left, and left perhaps for ever, beheld it like a huge, dull, copper shield, about two degrees in diameter, fixed immovably in the heavens overhead, and tipped on one of its edges with a crescent border of the most brilliant gold. No traces of land or water could be discovered, and the whole was clouded with variable spots, and belted with tropical and equatorial zones.

Thus, may it please your Excellencies, after a series of great anxieties, unheard-of dangers, and unparalleled escapes, I had at length, on the nineteenth day of my departure from Rotterdam, arrived in safety at the conclusion of a voyage undoubtedly the most extraordinary, and the most momentous, ever accomplished, undertaken or conceived by any denizen of earth. But my adventures yet remain to be related. And, indeed, your Excellencies may well imagine that, after a residence of five years upon a planet not only deeply interesting in its own peculiar character, but rendered doubly so by its intimate connexion, in capacity of satellite, with the world inhabited by man, I may have intelligence for the private ear of the States' College of Astronomers of far more importance than the details, however wonderful, of the mere *voyage* which so happily concluded. This is, in fact, the case.

I have much, very much, which it would give me the greatest pleasure to communicate. I have much to say of the climate of the planet; of its wonderful alternations of heat and cold; of unmitigated and burning sunshine for one fortnight, and more than polar frigidity for the next; of a constant transfer of moisture, by distillation like that *in vacuo*, from the point beneath the sun to the point the farthest from it; of a variable zone of running water; of the people themselves; of their manners, customs, and political institutions; of their peculiar physical constructions; of their ugliness; of their want of ears, those useless appendages in an atmosphere so peculiarly modified; of their consequent ignorance of the use and properties of speech; of their substitute for speech in a singular method of intercommunication; of the incomprehensible connexion between each particular individual in the moon with some particular individual on the earth—a connexion analogous with, and depending upon, that of the orbs of the planet and the satellite, and by means of which the lives and destinies of the inhabitants of the one are interwoven with the lives and destinies of the inhabitants of the other; and, above all, if it so please your Excellencies, above all, of those dark and hideous mysteries which lie in the outer regions of the moon—regions which, owing to the almost miraculous accordance of the satellite's rotation on its own axis with its sidereal revolution about the earth, have never yet been turned, and, by God's mercy, never shall be turned, to the scrutiny of the telescopes of man. All this, and more—much more—would I most willingly detail. But, to be brief, I must have my reward. I am pining for a return to my family and to my home; and as the price of any further communications on my part, in consideration of the light which I have it in my power to throw upon many very important branches of physical and metaphysical science, I must solicit, through the influence of your honourable body, a pardon for the crime of which I have been guilty in the death of the creditors upon my departure from Rotterdam. This, then, is the object of the present paper. Its bearer, an inhabitant of the moon, whom I have prevailed upon, and properly instructed, to be my messenger to the earth, will await your Excellencies' pleasure, and return to me with the pardon in question, if it can in any manner be obtained.

I have the honour to be, &c., your Excellencies' very humble servant,

HANS PFAALL.

Upon finishing the perusal of this very extraordinary document, Professor Rubadub, it is said, dropped his pipe upon the ground in the extremity of his surprise, and Mynheer Superbus Von Underduk, having taken off his spectacles, wiped them, and deposited them in his pocket, so far forgot both himself and his dignity as to turn round three times upon his heel in the quintessence of astonishment and admiration. There was no doubt about the matter—the pardon should be obtained. So at least swore, with a round oath, Professor Rubadub, and so finally thought the illustrious Von Underduk, as he took the arm of his brother in science, and, without saying a word, began to make the best of his way home to deliberate upon the measures to be adopted. Having reached the door, however, of the burgomaster's dwelling, the professor ventured to suggest that, as the messenger had thought proper to disappear (no doubt frightened to death by the savage appearance of the burghers of Rotterdam), the pardon would be of little use, as no one but a man of the moon would undertake a voyage to so vast a distance. To the truth of this observation the burgomaster assented, and the matter was therefore at an end. Not so, however, rumours and speculations. The letter, having been published, gave rise to a variety of gossip and opinion. Some of the over-wise even made themselves ridiculous by decrying the whole business as nothing better than a hoax. But hoax, with these sort of people, is, I believe, a general term for all matters above their comprehension. For my part, I cannot conceive upon what data they have founded such an accusation. Let us see what they say:—

Imprimis. That certain wags in Rotterdam have certain especial antipathies to certain burgomasters and astronomers.

Secondly. That an odd little dwarf and bottle-conjurer, both of whose ears, for some misdemeanor, have been cut off close to his head, has been missing for several days from the neighbouring city of Bruges.

Thirdly. That the newspapers which were stuck all over the little balloon were newspapers of Holland, and therefore could not have been made in the moon. They were dirty papers—very dirty; and Gluck, the printer, would take his Bible oath to their having been printed in Rotterdam.

Fourthly. That Hans Pfaall himself, the drunken villain, and the three very idle gentlemen styled his creditors, were all seen, no longer than two or three days ago, in a tippling-house in the suburbs, having just returned, with money in their pockets, from a trip beyond the sea.

Lastly. That it is an opinion very generally received, or which ought to be generally received, that the College of Astronomers in the city of Rotterdam, as well as all other colleges in all other parts of the world—not to mention colleges and astronomers in general—are, to say the least of the matter, not a whit better, nor greater, nor wiser than they ought to be.

Cornelius O'Dowd expressed the following opinion as late as October, 1864:—

. . . . Next to these [members of the Alpine Club] in order of utter uselessness are the people who go up in balloons, and who come down to tell us of the temperature, the air-currents, the shapes of the clouds, and amount of atmospheric pressure in a region where nobody wants to go, nor has the slightest interest to hear about.—*Blackwood's Magazine.*

By the kind permission of Messrs. Routledge I am able to add a chapter from the 'Younger Munchausen,' a new work, which is not one of the least amusing of Mr. Charles Bennett's writings.

When Mr. Coxwell told M. Godard that Munchausen knew less about balloons than Nadar, I felt at once that he was either blinded by jealousy or shrouded in ignorance.

Ballooning, I own, has presented to me many difficulties, but I have conquered most of them; and although Coxwell has taken away Mr. Glaisher's breath at a height of four miles from the earth——Has he ever been to the Moon?

I have.

He has built a gas balloon. Has he ever tried fire, water, Colza oil, petroleum, or chloroform?

He is contented with oiled silk. I should advise him to "go in," as I did, for cork, paper, india-rubber, sheet-lead, tin plates, cast-iron, or Scotch granite.

The CHAMBER of GENIUS.

(Pray excuse my feelings, but I cannot afford to be misrepresented, even by so great a man as my friend Coxwell.)

I always look upon myself as a born aeronaut; for when an infant, six weeks old, my nurse took me for an airing up Shakspeare's Cliff (we lived at Dover then), a strong wind carried me out of her arms, and I was borne safely across the British Channel to Calais, my ample petticoat forming a very excellent parachute.

I do not mean to say that I had much to do with the success of this feat myself, but I am led to believe that it gave a bias to my balloonacy.

Well can I remember passing along the streets of London in a shower of rain, holding over my head a large gingham gig-umbrella. I was then only a very little boy indeed, and the huge article was rather more than I could carry. I was on the point of selecting a convenient area, down which to drop it, when an explosion of gas at a baker's shop filled my enormous umbrella with hydrogen, and immediately converted it into a primitive aerial machine. It will not surprise you to be told that we at once cleared the houses, with but little damage to the surrounding chimney-pots, and that in a few minutes, firmly grasping the hooked end of my singular conveyance, I looked down to see the metropolis spread itself beneath me like a surging map. To what part of the world I might have been carried I cannot say, but as it occurred to my infant mind that the shutting up of the umbrella would answer all the purposes of a safety-valve, while the casting off of my boots (bluchers) would serve for the throwing out of ballast; I managed in due course of time to alight on Waterloo Bridge, to the horror and distraction of the toll-collector, who knew not how to demand a ha'penny from a child with a large gingham gig-umbrella, who had *not* passed through either of the turnstiles.

Still these were, as one may say, but the accidents of youth; it was at a somewhat later period that I gave myself up thoroughly to the study of aeronautics.

And in this way it happened:—

Fond of speculating about the mystery of gravitation, the question, "What is it that sticks us so tightly on to the earth?" was to me most interesting. Almost the first book that I read was one in which I found an authentic narrative of the adventures of a German student, who decanted two ounces of gravitation into a stoppered bottle, but inadvertently lost his bottle and his life by pulling out the stopper too far.

It occurred to me, on perusal of these facts, that if I had two ounces of the essence of gravitation, I could travel anywhere that I pleased, not fearing for one moment that Munchausen would come to grief over the stopper.

In pursuance of this desire, I sent down to Sheffield for five tons (100 cwt.) of magnetic ore, and procuring the same week from Birmingham one pound (16 oz. avoirdupois) of fluorite of cadmium, I crushed these two diverse materials in a steam-mill of my own invention, and when, by super-steam heat and galvanic batteries, I had developed the attractive segregation of particles, a heap was formed, which assumed conical dimension (45°). Of course then it was but easy work to collect the extract of gravitation in two-ounce vials, and to secure it therein by means of glass stoppers.

So far everything was simple; but, alas! now I found myself in possession of an utterly impracticable power.

It was too good to be useful.

No wonder the German student lost his life.

Even I could not control it. The moment the stopper was in the slightest degree released, off I flew from the earth with the rapidity of a discharged bombshell, stopping for nothing less than a planet or a fixed star.

The first experiment I tried shot me into the sun; the second, I shot myself back again, with a great burn on the bridge of my nose.

When I again released the stopper, it is true that I only reached the moon, but I so scratched myself against the man's faggots, that I wonder how I ever found sticking-plaster enough to heal my wounds.

Once I reached the Dog-star, which, by the by, is not a dog at all, nor much of a star either.

Finally, I got my uniform in such a frightful mess by tumbling into the Milky Way about skimming-time, that I put all my dangerous two-ounce vials on the top-shelf of my little corner cupboard, determined to give this daring scheme up for a bad job.

Nothing can ever induce me to use one of these bottles again.

But if I had so fruitlessly risked my life over essence of gravitation, it had but had the effect of settling my mind more firmly in the direction of balloons. It is true I had broken my arm, dislocated my thigh, fractured my skull, and broken my neck, in this series of experiments, which had proved too successful to be safe; but as

balloons, instead of making too quickly for the place of destination, ordinarily make for nothing at all in particular, I naturally felt that here, if anywhere, must be safety.

Armed with this idea, I at once purchased twenty thousand yards of oiled silk, cut the "gores" from my own pattern, set one hundred and twelve sewing-machines at work upon the seams, so that by the time I had completed my patent grapnel, and treble-action safety-valve, I had ready for ascent just simply the noblest and best-proportioned gas balloon that has ever yet been seen aloft. It was calculated to hold two hundred people, easy of ascent, easy of descent, but—and this is the evil of ordinary ballooning—entirely at the mercy of the winds. At first I tried to catch favourable currents and travel with the wind, but still I found, as Coxwell finds to this hour, that any one of the breezes that blow north, south, east, or west, was alike my master; this was not to be tolerated.

I invented my

PATENT FIVE-FOLD-RECURVED-NOZZLE-BALLOON-BELLOWS,

which blew up an opposition breeze, and carried me along even in spite of "rude Boreas."

When I tell you that to this hour I keep a small visiting balloon, with the "recurved attachment," in my back garden always inflated, you will at once understand that it must have been a tolerable success.

Indeed it was but a development of this plan that led to the establishment of my "self-acting messenger balloon," now rapidly taking the place of the electric telegraph, which indeed it is likely to entirely supersede. By means of this wonderful little machine you may send messages to all parts of the world, without any previous bother about submarine cables or housetop wires, and always look for an answer, as the "messenger" refuses to return without a proper reply. I cannot enter into all the details of this charming automaton, but will only mention that its movements are so regular as to give rise to a sort of arithmetical quality, which enables it to economise the little time it has to spare in casting up accounts at its leisure.

Babbage had no hand in it I assure you.

But talking of Babbage reminds me that there is a phrase in common use,—

"Castle in the Air."

Some gentlemen plead guilty to building them, but I must say that I am the inventor. Munchausen builds a better "Castle in the Air" than any one else I know. I have drawn a rude sketch of one; and you will see on looking at it that we get our gas from the superincumbent balloon: water we hang over the side in a butt; the household utensils hang over also, but not in a butt; the man-cook calls through his speaking-trumpet earthwards for coals; the gardener attaches a hose to the butt, and waters the garden; the old man in the bath below disports himself, but not quite at his leisure, as his son comes down the ladder to take his place; the larder is—best of places—on the hoop; *I* stand, with arms behind me, at the door, admiring my own ingenuity—and perhaps the only drawback that can be found in this admirable castle is, that both house and scullery maid are always popping their heads out of our first-floor window to see how the curiously bent chimneys smoke, as usually they do. Without this slight defect it would be perfect; as it is, this aerial castle has so well answered its purpose that this year Scarborough, Margate, and Chamouni are almost deserted, and if on a very bright evening you cast your eyes far enough, you will observe we have now quite an aerial city—the fashionable world no longer retires to its watering-place or its mountain, but quietly ascends to its castle-in-the-air—What *can* be pleasanter?

I might almost say that balloons are the rage: it was only last month that I was called upon by the celebrated Taylor, the furniture mover, to construct a balloon capable of moving house, furniture, front and back garden, all at one go. The affair is simple enough to the scientific mind: as houses are now-a-days built without foundations, it is merely a question of cables and balloon power, and there you are—the house rises easily enough, of course the furniture with it; as for the gardens we have some small difficulty with them, but by underlaying with strong timbers, they come away with the rest; we intend that all gardens in future shall rest on bottoms of concrete, which will save us a great deal of trouble.

For it is all important to save trouble. I saved the trouble of stopping, by making a balloon with motive power so vigorous, that once started it could never be stopped; and indeed it would give me an opportunity of claiming the annuity of ten thousand pounds, waiting so patiently for the inventor of perpetual motion, did it not in course of time wear itself out, when I am sorry to say it falls to pieces. Still, it is better than my "*summersault*

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Helsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c.Director.*

1864

*balloon*," which turns over and over like an aerial harlequin, giving itself a fresh impetus every turn. It is true that this machine was never known to wear out, and can hardly fall to pieces, but as it has such a tendency to produce a violent "air-sickness," I have thought it advisable to withdraw the patent.

One use, however, to which I have put this invention is worthy of further note. You can quite understand what a violent pull would be given by the sudden turning over of this machine; perhaps also you are aware that we have had this year a very hot summer.

Well, you wish to know what connexion the acrobat balloon has with the undue heat of the weather. I will tell you.

One million of these tumbling balloons harnessed in the foggy winter weather to this earth, sufficed to pull it a little nearer to the sun; hence the hot summer.

So you see balloons have been of some use one way and the other, if it be only to make grapes grow in England; although I would not for a moment suppose that all balloons are as useful; some are merely scientific toys.

Such as my kite balloon, which could not be guided by anything but the wind, it being composed of seven hundred kites, all sailing at one and the same time, dragging after them the car and its inmates. As for my bird balloon, that never came down again after it went up, for the first time it was borne in the air by a variety of strong-winged birds, but as the birds were not all of a feather they refused to flock, as the proverb says they should, and where they all went to nobody knows.

The butterfly balloon took too long to start, and when it was fairly off, only made about ten miles an hour, so it was not of much use.

The watch-spring balloon was also of little avail, because of the incessant trouble of winding up fifty thousand watches,—too much trouble for any six people, and that was all it could carry; still I must say, that I look upon the balloon as capable of superseding steam; indeed, I take it, that aerial machines may at some future time make the world itself quite useless for any but secondary purposes, as that of growing silkworms for balloon construction, and osiers wherewith to weave the cars;—perhaps a little coal to distil gas may be required, and always the earth must be preserved as a place to fall upon.

But be that as it may, one thing at least is certain, that the purposes to which balloons may be applied are almost innumerable.

I once went "drag netting" for Federals in America. We "rose" a balloon with double grapnels and wide-meshed net attached; hovering over the enemy, we watched our opportunity, and threw out our net on to the 97th Massachusetts Tiger Cats, capturing the whole regiment. My recurved bellows blew us back to the Confederate camp, and we dragged in, triumphantly, the whole of our prisoners.

People talk about disabling iron-clad ships with Sir William Armstrong's 900-pounder; but what necessity can there be for cannon, when, by plumbing your balloon ten miles above anything, fort, ship, house, or palace, you may just quietly drop over the edge of the car a missile—an explosive shell—that will put an end to it at once?

But among the purposes to which balloons may be turned, there is none more useful than that of irrigation. You see, in consequence of my having pulled the earth so far out of its beaten track, we have had not only a hot but a dry summer; the earth has been parched, cattle dying, crops perishing, while a few hundred of my PATENT AERIAL WATER CARS would have altered all that. Balloon goes up with a condensing apparatus, by which moisture is gathered at a high elevation; and it is then and there discharged upon the surface of the land in a series of gentle showers. By this means the sky is kept clear of mists, the earth is benefited by the showers, and as it is always possible to discharge the water after dark, the man of business can go about without his umbrella; the family can enjoy the sunshine at the sea-side, while the farmer has the means of forwarding or checking his crops ready to his hand.

Can anything be better?

* * *

But I will not trouble you any more with my stories about balloons; only, for the benefit of my friend Coxwell, I should like to set before him a few of the benefits of ballooning, as I intend to carry them out.

A balloon to light all England, by fixing it at such an elevation as to enable a strong and piercing light to illuminate the country round, from Land's End to John o' Groat's.

A balloon with which to discover new countries, by passing over hitherto inaccessible barriers.

A balloon with a large reflector and burning-glass, to bring a little summer heat round at Christmas time.

A balloon for delicate constitutions, to change its position according to the exact climate required.

A balloon to distribute advertisements all over the world.

A balloon for the Pre-Raphaelite artists, by which they may travel up close to the wonderful effects they are so fond of.

A balloon for people who want to keep out of the way; and

A detective balloon, by which the policemen can look down other people's chimneys, and through other people's skylights, and so find out "all about it."

I will not mention the thousand and one other and better purposes to which I propose putting balloons, but I think that while they give artificial sunshine and artificial rain, house without property-tax, and travelling without steam-engines, perhaps I have told you enough for the present.

At all events, if Coxwell will allow me, I mean to take Mr. Glaisher up to the moon in December, just when the "man" is getting his crop in, which will give Glaisher something else than wet bulbs, zeros, and short breath, to talk about to the British Association when they meet.

## LINES TO A WILD DUCK.

A duck has been immortalized by Bryant—
A wild one, too.
Sweetly he hymned the creature blithe and buoyant,
Cleaving the blue.

But whoso says the duck through ether flying,
Seen by the bard,
Equalled the canvas-back before me lying,
Tells a *canard*.

Done to a turn! The flesh a dark carnation,
The gravy red.
Four slices from the breast: on such a ration
Gods never fed!

Bryant, go to! To say thy lyric *ghost* duck,
Traced on the sky,
Was worthy to be named with this fine *roast* duck,
Is all my eye!

"OBSTANTES FINDIT NEBULAS."

# CHAPTER XII.

## "PROGRESS; OR, REVIEW OF THE PAST, AND THE HOPES FOR THE FUTURE."

"To everything there is a season, and a time to every purpose under the heaven."

ECCLESIASTES iii. 1.

CONFUCIUS'S TYPES, TIME AND SPACE — MAN'S PROGRESS TOWARDS HAPPINESS — THE CONTRIBUTIONS OF THE VARIOUS NATIONS THAT FORM OUR PRESENT COMMONWEALTH TO THIS SCIENCE — THE ORIGIN OF DISCOVERIES — THE ANALOGY THAT EXISTS IN THE DEVELOPMENT OF ANY SCIENCE; ASTRONOMY TAKEN AS AN INSTANCE — VICTOR HUGO'S XX^me SIÈCLE — PLEINE MER — PLEIN CIEL — CONCLUSION.

### SPACE (A SENTENCE FROM CONFUCIUS).

1.

DREIFACH ist der Schritt der Zeit:
Zögernd kommt die Zukunft hergezogen,
Pfeilschnell ist das Jetzt entflogen,
Ewig still steht die Vergangenheit.

2.

Dreifach ist des Raumes Masz.
Rastlos fort ohn' Unterlasz
Strebt die *Länge* fort ins Weite,
Endlos gieszet sich die *Breite*,
Grundlos senkt die *Tiefe* sich.

Dir ein Bild sind sie gegeben:
Rastlos vorwärts muszt du streben,
Nie ermüdet stille stehn,
Willst du die Vollendung sehn;
Muszt ins Breite dich entfalten,
Soll sich dir die Welt gestalten;
In die Tiefe muszt du steigen,
Soll sich dir das Wesen zeigen.
Nur Beharrung führt zum Ziel,
Nur die Fülle führt zur Klarheit,
Und im Abgrund wohnt die Wahrheit.

SCHILLER.

1.

Threefold the stride of Time, from first to last!
Loitering slow, the *Future* creepeth—
Arrow-swift, the *Present* sweepeth—
And motionless for ever stands the *Past*.

2.

A threefold measure dwells in Space—
Restless *Length*, with flying race;
Stretching forward, never endeth,
Ever widening, *Breadth* extendeth;
Ever groundless, *Depth* descendeth.

Types in these thou dost possess;—
Restless, onwards thou must press,
Never halt nor languor know,
To the Perfect wouldst thou go;—
Let thy reach with Breadth extend
Till the world it comprehend—
Dive into the Depth to see
Germ and root of all that be.
Ever onward must thy soul;—
'Tis the progress gains the goal;
Ever widen more its bound;
In the Full the clear is found,
And the Truth—dwells under ground.

SIR EDWARD BULWER LYTTON.

### I.

HAVING now reviewed the most salient points of all that has been accomplished and suggested with regard to aerostation, though many valuable ideas may have escaped us, let us now recall briefly the general progress of science, and the important results which we may now fairly anticipate for this branch of it.

"Man's twofold nature," says Carlyle, "is reflected in history. He is of earth, but his thoughts are with the stars. Mean and petty his wants and his desires, yet they serve a soul exalted with grand, glorious aims, with immortal longings, with thoughts which sweep the heavens, and wander through eternity. A pigmy standing on the outward crust of this small

planet, his far-reaching spirit stretches outwards to the infinite, and there alone finds rest. History is a reflex of this double life. Every epoch has two aspects, one calm, broad, and solemn, looking towards eternity; and the other agitated, petty, vehement, and confused, looking towards time."

THE LIAS, OR A FOOT-PRINT OF THE PAST.

With what line or series, then, shall we connect the *Pterodactyle* of the oolite? There is no motion of which that extraordinary animal could not partake. It could walk, swim, and fly, leap over great spaces, and float in the air, sustained as by a parachute; and if its instincts were commensurate with its powers, it would stand out wholly as an anomaly, having neither predecessor nor descendant.—NICHOL'S *System of the World*.

Methought I saw
Life swiftly treading over endless space,
And, at her foot-print, but a bygone pace,
The ocean-past, which, with increasing wave,
Swallow'd her steps like a pursuing grave.
TENNYSON.

George Combe says:—

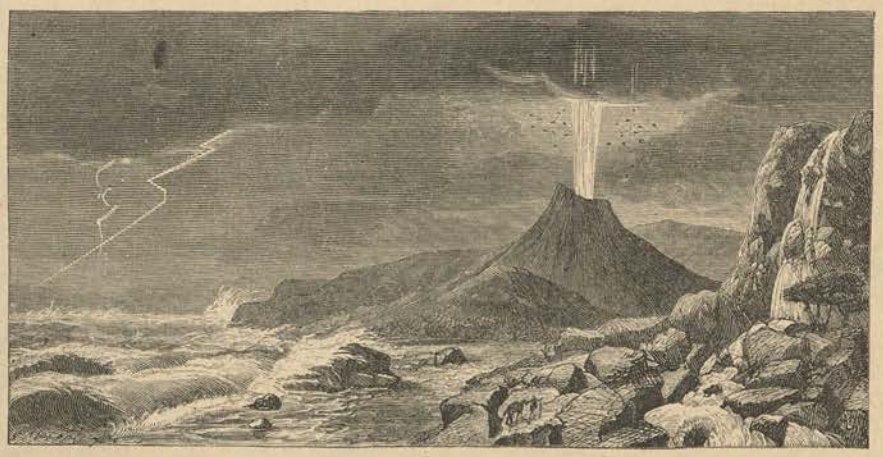
At the time of the Roman invasion, the inhabitants of Britain lived as savages, and appeared in painted skins. After the Norman conquest, one part of the nation was placed in the condition of serfs, condemned to labour like beasts of burden, while the other devoted itself to war. The nobles fought battles during the day, and in the night probably dreamed of bloodshed and broils. Next came the age of chivalry. These generations severally believed

their own condition to be the highest, or at least the permanent and inevitable lot of Man. Now, however, have come the present arrangements of society, in which millions of men are shut up in cotton-mills and other manufactories for ten or twelve hours a day; others labour under ground in mines; others plough the fields; while thousands of higher rank pass their lives in frivolous amusements. The elementary principles of the human constitution, both bodily and mental, were the same in our painted ancestors, and in their chivalrous descendants, as they are in us, their shopkeeping, manufacturing, and money-gathering children. Yet how different the external circumstances of these several generations! If, in the savage state, the mental faculties of Man were in harmony among themselves and with his external circumstances, he must then have enjoyed all the happiness of which his nature was capable, and have erred when he changed his condition; if the institutions and customs of the age of chivalry were calculated to gratify his whole nature harmoniously, he must have been unhappy as a savage, and must be miserable now; if his present condition be the perfection of his nature, he must have been far from enjoyment both as a savage and as a feudal warrior; and, if none of these conditions have been in accordance with his constitution, he must still have his happiness to seek.

Every age, accordingly, has testified that *it* was not in possession of contentment; and the question presents itself, If human nature has received a definite constitution, and if one arrangement of external circumstances is more suited to yield it gratification than another, what *are* that constitution and that arrangement? No one among the philosophers has succeeded in giving us a satisfactory answer to these questions. If we in Britain have not reached the limits of attainable perfection, what are we next to attempt? Are we and our posterity to spin and weave, build ships, and speculate in commerce, as the highest occupations to which Man can aspire, and to persevere in these labours as the highest till the end of time? If not, *who shall pilot us in our future voyage on the ocean of existence, and by what chart of philosophy shall our steersman be guided?*

The British people are here cited as a type of mankind at large; for in every age and every clime, similar races have been run, with similar conclusions. One answer may be returned to these inquiries.

Man is apparently a progressive being.



"EARTH, WATER, AIR, FIRE—SOLVE ME THIS RIDDLE WHO CAN?"

Ich wohn' in einem steinernen Haus,
Da lieg' ich verborgen und schlafe;
Doch ich trete hervor, ich eile heraus,
Gefordert mit eiserner Waffe.
Erst bin ich unscheinbar und schwach und klein,
Mich kann dein Athem bezwingen,
Ein Regentropfen schon saugt mich ein;
Doch mir wachsen im Siege die Schwingen.
Wenn die mächtige Schwester sich zu mir gesellt,
Erwachs' ich zum furchtbarn Gebieter der Welt.

SCHILLER.

In a Dwelling of stone I conceal
My existence obscure and asleep;
But forth at the clash of the steel,
From my slumber exulting I leap!
At first, all too feeble for strife,
Thou hast but to breathe and I die;
A drop would extinguish my life—
But my wings soon expand to the sky!
Let the might of my Sister * afford
Its aid to those wings when unfurl'd,
And I grow to a terrible Lord,
Whose anger can ravage the world.†

SIR EDWARD BULWER LYTTON.

* The air. † Fire.

We might continue; but lately there have been many popular writers who have shown the analogy between the growth of the mind of a nation, and that of a man from his childhood; and the wider the survey both of centuries and countries that these works include, the more apparent does this become. We can therefore only venture to call the fact to mind whilst we make note of the chief contributions of various nations to this division of science.

## II.

To FRANCE, as we have seen, belongs all the "*éclat*" of this branch of knowledge, so well suited to the brilliancy, vivacity, and showiness of her character; but let us accept also the judgment of one of the ablest of her writers on it, when he speaks of the ease with which she is disappointed:—"Qu'il est malheureusement dans les habitudes de l'esprit français de manquer de persévérance; que souvent il laisse échapper et passer à l'extérieur les découvertes faites chez lui; et que, pour les accueillir, il leur faut en quelque sorte le baptême de l'approbation étrangères."

In ENGLAND the most important and necessary element in this acquisition was made by the researches of Cavendish, Black, and Watt, who discovered the specific gravity of gases, and the decomposition of water.

But let us not forget ITALY, as we owe to her many ideas. I will therefore quote Draper's 'Intellectual Development of Europe,' wherein he speaks justly, I think, of the beautiful peninsula in these words:—

In this scientific advancement, among the triumphs of which we are living, all the nations of Europe have been engaged. Some, with a venial pride, claim for themselves the glory of having taken the lead. But perhaps each of them, if it might designate the country—alas! not yet a nation—that would occupy the succeeding post of honour, would inscribe Italy on its ballot. It was in Italy that Columbus was born; in Venice, destined one day to be restored to Italy, newspapers were first issued. It was in Italy that the laws of the descent of bodies to the earth and of the equilibrium of fluids were first determined by Galileo. In the cathedral of Pisa that illustrious philosopher watched the swinging of the chandelier, and observing that its vibrations, large and small, were made in equal times, left the house of God, his prayers unsaid, but the pendulum clock reinvented. To the Venetian senators he first showed the satellites of Jupiter, the crescent form of Venus, and, in the garden of Cardinal Bandini, the spots upon the sun. *It was in Italy that Sanctoris invented the thermometer; that Torricelli constructed the barometer and demonstrated the pressure of air.* It was there that Castelli laid the foundation of hydraulics, and discovered the laws of the flowing of water. There, too, the first Christian astronomical observatory was established; and there Stancari counted the number of vibrations of a string emitting musical notes. There Grimaldi discovered the diffraction of light; and the Florentine academicians showed that dark heat may be reflected by mirrors across space. In our own times Melloni furnished the means of proving that it may be polarised. The first philosophical societies were the Italian; the first botanical garden was established at Pisa; the first classification of plants given by Cæsalpinus. The first geological museum was founded at Verona; the first who cultivated the study of fossil remains were Leonardo da Vinci and Tracasta. The great chemical discoveries of this century were made by instruments which bear the names of Galvani and Volta. Why need I speak of science alone? Who will dispute with that illustrious people the palm of music and painting, of statuary and architecture? The dark cloud which for a thousand years has hung over that beautiful peninsula is fringed with irradiations of light. There is not a department of human knowledge from which Italy has not extracted glory, no art that she has not adorned.

GERMANY has aided us with poetic conceptions, but feebly expressed by the vignettes that adorn this work, and more powerfully by the pen of Schiller, breathing forth some of the

strongest of human aspirations. They have also welcomed those aeronauts of France and England who have exhibited to them the imperfect machines they possess.

AMERICA also has assisted by practical observations that have resulted in an excellent volume by the experienced Mr. Wise.

This is, as far as the information at my disposal extends, the extent of the outline of the contributions of the nations that form our present Commonwealth.

From the annexed list of the first five hundred known aeronauts throughout the world, some of whom have devoted their whole lives to the science, and a few have fallen a sacrifice to their experiments, we see how large is the majority of Englishmen. This list was carefully compiled by M. Depuis Delcourt in 1824, much enlarged by Monck Mason in 1837, and again revised by M. Depuis Delcourt in 1848, and is, I think, nearly correct.

It will here, perhaps, be opportune to notice the extent of the development which the science of aerostation has hitherto received, and the similarity that exists between it and the progress of other sciences.

## III.

The following are the remarks (written about 1838) that commence an "Inquiry into the Uses and Capabilities of the Balloon-projected Voyage across the Atlantic":—

It is an observation not undeserving the attention of the philosophical inquirer, how seldom it has happened that the dawn of discoveries in the arts and sciences has been commensurate in point of *éclat* with the brilliancy which has accompanied their subsequent career of practical application. Of the inventions which have most contributed to raise the standard of civilisation and the periods of which in history form, as it were, epochs of improvement in the moral and social condition of mankind, how few there are whose first announcement has experienced a consideration in any way equivalent to the rank they have since been deemed entitled to hold! while, on the other hand, of those discoveries which most awakened the applause of contemporaneous nations, how many might be cited whose results, so far from justifying, seem almost to mock the enthusiasm which hailed their original promulgation!

Of the former of these positions, the circumstances attending the rise and progress of the three great engines of modern supremacy in war, in literature, and in commerce—gunpowder, the art of printing, and the motive agency of steam, afford sufficient illustration; while, in exemplification of the latter, we need only refer to the still more recent discovery of the science of aerostation. Greeted with a universality and fervour of applause never before conceded to the most exalted effort of human ingenuity or enterprise, honoured by royal co-operation, eulogised by the learned, courted by the rich, discussed, lauded, and criticised to the almost total exclusion, for a while, of every other topic of literary or public interest, its reception was indeed such as can only be excused or explained by reference to the feelings of the world upon having, as it conceived, suddenly acquired the solution of a problem upon which it had, from time immemorial, concentrated its best energies and fixed its most fervent aspirations. How far these expectations have been justified by the results, it is unfortunately not necessary to inquire.

And yet, notwithstanding the since ascertained exaggeration of these sentiments, some apology may be found for the erroneous anticipations prevalently entertained upon a matter apparently fraught with such interesting and important consequences. To determine the real prospects of a new theory is the province of the professed philosopher, and is frequently only to be accomplished with certainty by the intervention of science in its severest and most recondite form. The branch of science which alone bears upon the question of aerial navigation or the guidance of the balloon (the point towards which all men's minds were, at the outset, incontinently directed), was not that which, at the time, occupied the attention of the *savans* of France, where, it is well known, the first successful attempts were made to give a practical illustration of the art. Chemistry and natural history, themselves only in their infancy, were the fashionable and almost exclusive studies of the day; mathematics and the physical sciences, by which alone, as we have said, the forces developed in the prosecution of any attempt to govern the

movements of the atmosphere, could be calculated or ascertained, were so little pursued that few were in a condition to pronounce upon the capabilities of any project of the nature alluded to, or even to suspect that a sufficient conclusion could be arrived at (without actual experiment) by the mere force of *à priori* investigation. Hence the various practical attempts made to ascertain the efficiency of schemes, the prospects of which could have been determined much more satisfactorily (because, independent of all considerations of the accuracy or inaccuracy of the mechanism) by the process of mathematical deduction.

In England this enthusiasm, it is true, never rose to the same pitch, and consequently never experienced the same revulsion. More accustomed to weigh consequences, and ever disposed to doubt almost in inverse proportion to the magnitude of the advantages to be attained by success, the very grounds of its recommendation to a less prudential people, operated to suspend the judgment and abate the expectations of the inhabitants of this country, and it early became a fashion in England to decry its prospects and ridicule its pretensions, as much almost as our more mercurial neighbours were disposed to fall into the opposite extreme.

Such we know is the nature of man, especially when engaged upon a matter of engrossing interest, that no declaration of opinion founded upon a partial development of the features of a case will ever avail to produce conviction, or determine his efforts or expectations. Where mere mechanical difficulties are all that impede success, no arguments indeed are likely to prove satisfactory. Difficulties which are insurmountable by one man under one set of circumstances, might prove no difficulties to another differently circumstanced and differently endowed. At all events, no decisive negative can be imposed upon the success of an undertaking to the accomplishment of which a higher degree of knowledge and more extended resources are all that are required. Indeed, it is from viewing the question of aerial propulsion in this light—namely, as one of mere mechanical prowess,—that may be said to have arisen the contrariety of opinion which has hitherto existed, and still, in a less degree, continues to prevail upon the subject. To be able to construct wings or motive organs of similar effect, and adopt a power sufficient to set them in motion, either in the way practised by birds, fishes, or by vessels propelled by steam (or otherwise, as the fancy of the projector may incline), is, when viewed apart from any particular limitation, a feat in which many persons might fail, and yet one more skilful than the rest might still hope to succeed. *When, however, upon taking into consideration all the requisitions of the case, we find, by strict mathematical deduction, that, in order to effect the end desired, it is necessary that these wings or other organs must be of a given capacity, and operate according to a given force, and that this capacity and this force are such as neither the materials we possess, nor the natural powers we can command, are competent to create, we redeem the question from the class of mechanical difficulties, and assign it a place in that of natural impossibilities.*

Such then appears to be the case with regard to the conversion of the *balloon* into a means of transport applicable to the ordinary purposes of life, and we are willing here to express our acknowledgments to Mr. Monck Mason for having, in his work upon aerostation, recently published by Mr. Westley, exhibited the matter in that light. To transcribe all the arguments by which this view of the case is supported would, as we have already stated, exceed the limits here allotted to us; while to repeat a part only would leave the point as unsatisfactory and open to discussion as before. All we can here do is to refer the reader to the work in question for the particulars, and register the conclusion they seem calculated to sustain.

We have put in italics the just conclusion to which a clear and candid mind arrived at after reading Mr. Monck Mason's calculations; but we have already shown how erroneous these were, *since we can now affirm the practicability of aerial navigation to be demonstrated by mathematical deduction.* [See 'Études sur l'Aérostation, par M. Marey Monge;' for extracts, p. 336 of this work.]

Mr. Coxwell, after twenty years devoted to the study of this science, expresses himself as follows in a number of the 'Aerostatic Magazine' for 1859:—

We who examine aerostation historically, are not surprised that quick and powerful minds should have been raised to high expectation, and yet doomed to disappointment. But we *should be* quite astonished if, after all we have read of the rise and progress of the arts and sciences, this particular one should deviate from the regular order, and develop itself with extraordinary precocity; seeing, as we do, that inventions and discoveries generally follow one uniform course, and only yield their treasures, as do gold-fields their nuggets, after hard exertions and untiring efforts. There are, of course, exceptions, both as to the arts and to gold-seeking, but we find it the rule; and very

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supremely ordered it is, especially as it applies to aerial locomotion, for I have no hesitation in affirming that the advantages likely to accrue from unrestrained intercourse through the atmosphere are so great and exalting, that the world is hardly yet prepared for such a consummation. If astronomy, geology, steam-power, electricity, and nautical science cannot boast of having made one bound towards perfection, why should ballooning? We have only just succeeded in making ships go against the wind, and why should we despair of mastering an aerial vehicle? The difficulties to be surmounted are well understood, and for a time baffle ingenuity; but I would urge renewed attempts, for remember, it is not eighty years since the first balloon travelled the air, and if we could now inspect a specimen of a boat constructed eighty years after men began to venture on the water, depend upon it we would sooner cross the Atlantic in the 'Great Eastern' than venture to Gravesend in the primitive pigmy of our forefathers. Ballooning as an art, is, I am convinced, steadily advancing; and although the uninitiated may not observe much progress, because the machine does not strikingly deviate from the wind, yet the various appurtenances gradually undergo improvement, and in a short time, I have no doubt that balloons, like the old men-of-war, will be cast aside for new models; and then, just as the application of steam requires a reconstruction of our war vessels, so will some new power demand a similar alteration for vessels in the air; so that if balloons cannot be managed, elongated aerostats may, and the difficulties which appeared insurmountable at the beginning of the nineteenth century may be at last dispelled, and the great high-road to all the nations of the earth (the atmosphere) may be travelled triumphantly.

Let us draw attention to the oldest and sublimest of the sciences, and learn from the achievements of her pioneers, which have been so eloquently recorded by Nichol in his 'Solar System,' and other works, what we may in some degree anticipate for aerostation :—

"It is seldom easy to ascertain why or how a new truth is revealed,—that majestic event usually occurring when old systems seem to have reached their climax and achieved perfection. When, however, the still small voice does come, it is one of dread. The accomplished part of the world feels as in an earthquake; although the deserts may rejoice at the rising light."

*First, Copernicus.* "He threw from him the weight of ages, and quietly asked whether that fundamental tenet, which asserts that the earth is motionless, might not be false. The mental effort required, even to hesitate on a point which all mankind had up to that moment undoubtingly believed, and which had now inwoven itself with every mode of thought, was an achievement for the loftiest order of genius; the question being put, it required only superior but not uncommon talent, to follow it to its conclusions."

*Then, a Tycho and Kepler.* "It is usually assumed as an axiom, that when Science desires a great man to accomplish some specific object, one with faculties altogether adequate is certain to appear and achieve his mission; the two men here spoken of were, in this case, nobly adapted to the required task, but each only to his own department of it. The genius of the Dane lay exclusively with observation, in which field he stands beside Hipparchus; while, on the contrary, Kepler thirsted after analogies and relations. Tycho had no power to theorise; and when he attempted it, the failure was miserable. Kepler's enthusiasm made his whole life that of a theorist, divided between the pursuit of mystical relations, and the discovery of some of the noblest truths in the science of astronomy;—an enthusiasm, however, most diverse from that of the common theorist, who usually seeks not after truth but distinction, and is pleased no better with a great discovery, than a startling and noisy paradox: for, springing from the finest genius, it prompted him for ever to search out real relations, and, until those relations were discovered, never to be at rest. If his ardent, speculative, and often erring mind, had been truly in union, in the same person, with the faculties of the calm, observant, and unphilosophical Tycho, it could not have otherwise befallen it, than to be an instrument of importance scarce calculable towards the reformation of all science: and the truth is, the imperfect union which did take place—the happy association, until Tycho's death, of the two persons, and Kepler's subsequent and most pious devotion to the memory of his patron and master—has produced a period second to none in the importance of the truth it revealed, and which therefore will always be illustrious."

Kepler says of himself after making the discovery of the *Unity of Structure in the Planetary System* :—

. . . . It is now eighteen months since I got the first glimpse of light, three months since the dawn, very

few days since the unveiled sun, most admirable to gaze on, burst out upon me. Nothing holds me: I will indulge in my sacred fury: I will triumph over mankind by the honest confession that I have stolen the golden vases of the Egyptians, to build up a tabernacle for my God far away from the confines of Egypt. If you forgive me, I rejoice; if you are angry, I can bear it; the die is cast, the book is written, to be read either now or by posterity—I care not which; it may well wait a century for a reader, as God has waited six thousand years for an observer!

The apple falls to the ground, and Newton unravels the mystery, completes the first step of a boundless research, and acknowledges that he is "but as a child, standing on the shore of the vast and unexplored ocean, and playing with a little pebble which the waters have washed to his feet:"—

SEE! ALL THINGS WITH EACH OTHER BLENDING—
EACH TO ALL ITS BEING LENDING:
ALL ON EACH IN TURN DEPENDING—
HEAVENLY MINISTERS DESCENDING,
AND AGAIN TO HEAVEN UP-TENDING:
FLOATING, MINGLING, INTERWEAVING,
RISING, SINKING, AND RECEIVING
EACH FROM EACH, WHILE EACH IS GIVING
ON TO EACH, AND EACH RELIEVING
EACH, THE PAILS OF GOLD, THE LIVING
CURRENT THROUGH THE AIR IS HEAVING
BREATHING BLESSINGS, SEE THEM BENDING—
BALANCED WORLDS FROM CHANGE DEFENDING;
WHILE, EVERYWHERE DIFFUSED, IS HARMONY UNENDING!

Do we not find encouragement here? Are not all sciences strengthened by the completion of so beautiful an arch? May not we therefore anticipate for aerostation future progression as definitely marked? Or must it be with it, as with the science of marine navigation, that the donations of the most valuable inventors (I had nearly said discoverers) are lost among the thousands of patents that with gradual steps have caused that display of skill and ingenuity that we find in a dockyard?

## IV.

For a glimpse of the future, analogous to our Second Chapter, I will quote Victor Hugo's 'Vingtième Siècle'*:—

### PLEINE MER.

*

L'abîme; on ne sait quoi de terrible qui gronde;
Le vent; l'obscurité vaste comme le monde;
Partout les flots; partout où l'œil peut s'enfoncer,
La rafale qu'on voit aller, venir, passer;
L'onde, linceul; le ciel, ouverture de tombe;
Les ténèbres sans l'arche et l'eau sans la colombe;
Les nuages ayant l'aspect d'une forêt.
Un esprit qui viendrait planer là, ne pourrait
Dire, entre l'eau sans fond et l'espace sans borne,
Lequel est le plus sombre, et si cette horreur morne,
Faite de cécité, de stupeur et de bruit,
Vient de l'immense mer ou de l'immense nuit.

L'œil distingue, au milieu du gouffre où l'air sanglote,
Quelque chose d'informe et de hideux qui flotte,
Un grand cachalot mort à carcasse de fer,
On ne sait quel cadavre à vau-l'eau dans la mer;
Œuf de titan dont l'homme aurait fait un navire.
Cela vogue, cela nage, cela chavire;
Cela fut un vaisseau; l'écume aux blancs amas
Cache et montre à grand bruit les tronçons de sept mâts;
Le colosse, échoué sur le ventre, fuit, plonge,
S'engloutit, reparaît, se meut comme le songe;
Chaos d'agrès rompus, de poutres, de haubans;
Le grand mât vaincu semble un spectre aux bras tombants
L'onde passe à travers ce débris; l'eau s'engage
Et déferle en hurlant le long du bastingage,
Et tourmente des bouts de corde à des crampons
Dans le ruissellement formidable des ponts;
La houle éperdument furieuse saccage
Aux deux flancs du vaisseau les cintres d'une cage

* 'La Légende des Siècles.'

Où jadis une roue effrayante a tourné ;
Personne ; le néant, froid, muet, étonné ;
D'affreux canons rouillés tendent leurs cous funestes ;
L'entre-pont a des trous où se dressent les restes
De cinq tubes pareils à des clairons géants,
Pleins jadis d'une foudre, et qui, tordus, béants,
Ployés, éteints, n'ont plus, sur l'eau qui les balance,
Qu'un noir vomissement de nuit et de silence ;
Le flux et le reflux, comme avec un rabot,
Dénude à chaque coup l'étrave et l'étambot,
Et dans la lame on voit se débattre l'échine
D'une mystérieuse et difforme machine.
Cette masse sous l'eau rôde, fantôme obscur.
Des putréfactions fermentent, à coup sûr,
Dans ce vaisseau perdu sous les vagues sans nombre ;
Dessus, des tourbillons d'oiseaux de mer ; dans l'ombre,
Dessous, des millions de poissons carnassiers.
Tout à l'entour, les flots, ces liquides aciers,
Mêlent leurs tournoiements monstrueux et livides.
Des espaces déserts sous des espaces vides.
O triste mer ! sépulcre où tout semble vivant !
Ces deux athlètes faits de furie et de vent,
Le tangage qui bave et le roulis qui fume,
Luttant sur ce radeau funèbre dans la brume,
Sans trêve, à chaque instant arrachent quelque éclat
De la quille ou du pont dans leur noir pugilat ;
Par moments, au zénith un nuage se troue,
Un peu de jour lugubre en tombe, et, sur la proue,
Une lueur, qui tremble au souffle de l'autan,
Blême, éclaire à demi ce mot : LÉVIATHAN.
Puis l'apparition se perd dans l'eau profonde ;
Tout fuit.

Léviathan ; c'est là tout le vieux monde,
Apre et démesuré dans sa fauve laideur ;
Léviathan, c'est là tout le passé : grandeur,
Horreur.

*

Le dernier siècle a vu sur la Tamise
Croître un monstre à qui l'eau sans bornes fut promise,
Et qui longtemps, Babel des mers, eut Londre entier
Levant les yeux dans l'ombre au pied de son chantier.
Effroyable, à sept mâts mêlant cinq cheminées
Qui hennissaient au choc des vagues effrénées,
Emportant, dans le bruit des aquilons sifflants,
Dix mille hommes, fourmis éparses dans ses flancs,
Ce Titan se rua, joyeux, dans la tempête ;
Du dôme de Saint-Paul son mât passait le faîte ;
Le sombre esprit humain, debout sur son tillac,
Stupéfiait la mer qui n'était plus qu'un lac ;
Le vieillard Océan, qu'effarouche la sonde,
Inquiet, à travers le verre de son onde,
Regardait le vaisseau de l'homme grossissant ;
Ce vaisseau fut sur l'onde un terrible passant ;
Les vagues frémissaient de l'avoir sur leurs croupes ;
Ses sabords mugissaient ; en guise de chaloupes,
Deux navires pendaient à ses portemanteaux ;
Son armure était faite avec tous les métaux ;
Un prodigieux câble ourlait sa grande voile ;
Quand il marchait, fumant, grondant, couvert de toile,
Il jetait un tel râle à l'air épouvanté
Que toute l'eau tremblait, et que l'immensité
Comptait parmi ses bruits ce grand frisson sonore ;
La nuit, il passait rouge ainsi qu'un météore ;
Sa voilure, où l'oreille entendait le débat
Des souffles, subissant ce gréement comme un bât,
Ses hunes, ses grelins, ses palans, ses amures,
Étaient une prison de vents et de murmures ;
Son ancre avait le poids d'une tour ; ses parois
Voulaient les flots, trouvant tous les ports trop étroits ;
Son ombre humiliait au loin toutes les proues ;
Un télégraphe était son porte-voix ; ses roues
Forgeaient la sombre mer comme deux grands marteaux ;
Les flots se le passaient comme des piédestaux
Où, calme, ondulerait un triomphal colosse ;
L'abîme s'abrégeait sous sa lourdeur véloce ;
Pas de lointain pays qui pour lui ne fût près ;
Madère apercevait ses mâts ; trois jours après,
L'Hékla l'entrevoyait dans la lueur polaire.
La bataille montait sur lui dans sa colère.
La guerre était sacrée et sainte en ces temps-là ;
Rien n'égalait Nemrod si ce n'est Attila ;
Et les hommes, depuis les premiers jours du monde,
Sentant peser sur eux la misère infeconde,
Les pestes, les fléaux lugubres et railleurs,
Cherchant quelque moyen d'amoindrir leurs douleurs,
Pour établir entre eux de justes équilibres,
Pour être plus heureux, meilleurs, plus grands, plus libres,
Plus dignes du ciel pur qui les daigne éclairer,
Avaient imaginé de s'entre-dévorer.
Ce sinistre vaisseau les aidait dans leur œuvre.
Lourd comme le dragon, prompt comme la couleuvre,
Il couvrait l'Océan de ses ailes de feu ;
La terre s'effrayait quand sur l'horizon bleu
Rampait l'allongement hideux de sa fumée,
Car c'était une ville et c'était une armée ;
Ses pavois fourmillaient de mortiers et d'affûts,
Et d'un hérissement de bataillons confus ;
Ses grappins menaçaient ; et, pour les abordages,
On voyait sur ses ponts des rouleaux de cordages
Monstrueux qui semblaient des boas endormis ;
Invincible, en ces temps de frères ennemis,
Seul, de toute une flotte il affrontait l'émeute,
Ainsi qu'un éléphant au milieu d'une meute ;
La bordée à ses pieds fumait comme un encens,
Ses flancs engloutissaient les boulets impuissants,
Il allait broyant tout dans l'obscure mêlée,
Et, quand, épouvantable, il lâchait sa volée,
On voyait flamboyer son colossal beaupré,
Par deux mille canons brusquement empourpré.
Il méprisait l'autan, le flux, l'éclair, la brume.
A son avant tournait, dans un chaos d'écume,
Une espèce de vrille à trouer l'infini ;
Le Malström s'apaisait sous sa quille aplani.
Sa vie intérieure était un incendie ;
Flamme au gré du pilote apaisée ou grandie ;
Dans l'antre d'où sortait un vaste mouvement,
Au fond d'une fournaise on voyait vaguement
Des êtres ténébreux marcher dans des nuées
D'étincelles, parmi les braises remuées ;
Et pour âme il avait dans sa cale un enfer.
Il voguait, roi du gouffre, et ses vergues de fer
Ressemblaient, sous le ciel redoutable et sublime,
A des sceptres posés en travers de l'abîme ;
Ainsi qu'on voit l'Etna l'on voyait ce steamer ;
Il était la montagne errante de la mer ;
Mais les heures, les jours, les mois, les ans, ces ondes,
Ont passé ; l'Océan, vaste, entre les deux mondes,

A rugi, de brouillard et d'orage obscurci ;
La mer a ses écueils cachés, le temps aussi ;
Et maintenant, parmi les profondeurs farouches,
Sous les vautours, qui sont de l'abîme les mouches,
Sous le nuage, au gré des souffles, dans l'oubli
De l'infini, dont l'ombre affreuse est le repli,
Sans que jamais le vent autour d'elle s'endorme,
Au milieu des flots noirs roule l'épave énorme!

*

L'ancien monde, l'ensemble étrange et surprenant
De faits sociaux, morts et pourris maintenant,
D'où sortit ce navire aujourd'hui sous l'écume,
L'ancien monde, aussi, lui, plongé dans l'amertume,
Avait tous les fléaux pour vents et pour typhons.
Construction d'airain aux étages profonds,
Sur qui le mal, flot vil, crachait sa bave infâme,
Plein de fumée, et mu par une hydre de flamme,
La Haine, il ressemblait à ce sombre vaisseau.
Le mal l'avait marqué de son funèbre sceau.

Ce monde, enveloppé d'une brume éternelle,
Était fatal ; l'Espoir avait plié son aile ;
Pas d'unité ; divorce et joug ; diversité
De langue, de raison, de code, de cité ;
Nul lien, nul faisceau ; le progrès solitaire,
Comme un serpent coupé, se tordait sur la terre,
Sans pouvoir réunir les tronçons de l'effort ;
L'esclavage, parquant les peuples pour la mort,
Les enfermait au fond d'un cirque de frontières
Où les gardaient la Guerre et la Nuit, bestiaires ;
L'Adam slave luttait contre l'Adam germain ;
Un genre humain en France, un autre genre humain
En Amérique, un autre à Londre, un autre à Rome ;
L'homme au delà d'un pont ne connaissait plus l'homme ;
Les vivants, d'ignorance et de vice chargés,
Se traînaient ; en travers de tout, les préjugés ;
Les superstitions étaient d'âpres enceintes
Terribles d'autant plus qu'elles étaient plus saintes ;
Quel créneau soupçonneux et noir qu'un Alcoran !
Un texte avait le glaive au poing comme un tyran ;
La loi d'un peuple était chez l'autre peuple un crime ;
Lire était un fossé, croire était un abîme ;
Les rois étaient des tours ; les dieux étaient des murs ;
Nul moyen de franchir tant d'obstacles obscurs ;
Sitôt qu'on voulait croître, on rencontrait la barre
D'une mode sauvage ou d'un dogme barbare ;
Et, quant à l'avenir, défense d'aller là.

*

Le vent de l'infini sur ce monde souffla.
Il a sombré. Du fond des cieux inaccessibles,
Les vivants de l'éther, les êtres invisibles
Confusément épars sous l'obscur firmament,
A cette heure, pensifs, regardent fixement
Sa disparition dans la nuit redoutable.
Qu'est-ce que le simoun a fait du grain de sable ?
Cela fut. C'est passé ! cela n'est plus ici.

*

*Ce monde est mort. Mais quoi ! l'homme est-il mort aussi?*
*Cette forme de lui disparaissant, l'a-t-elle*
*Lui-même remporté dans l'énigme éternelle ?*
*L'Océan est désert. Pas une voile au loin.*
*Ce n'est plus que du flot que le flot est témoin.*
*Pas un esquif vivant sur l'onde où la mouette*
*Voit du Léviathan rôder la silhouette.*
*Est-ce que l'homme, ainsi qu'un feuillage jauni,*
*S'en est allé dans l'ombre ? est-ce que c'est fini ?*
*Seul le flux et reflux va, vient, passe et repasse.*
Et l'œil, pour retrouver l'homme absent de l'espace,
Regarde en vain là-bas. Rien.

Regardez là-haut.

## PLEIN CIEL.

*

Loin dans les profondeurs, hors des nuits, hors du flot,
Dans un écartement de nuages, qui laisse
Voir au-dessus des mers la céleste allégresse,
Un point vague et confus apparaît ; dans le vent,
Dans l'espace, ce point se meut ; il est vivant ;
Il va, descend, remonte ; il fait ce qu'il veut faire ;
Il approche, il prend forme, il vient ; c'est une sphère ;
C'est un inexprimable et surprenant vaisseau,
Globe comme le monde et comme l'aigle oiseau ;
C'est un navire en marche. Où ? Dans l'éther sublime !

Rêve ! on croit voir planer un morceau d'une cime ;
Le haut d'une montagne a, sous l'orbe étoilé,
Pris des ailes et s'est tout à coup envolé ?
Quelque heure immense étant dans les destins sonnée,
La nue errante s'est en vaisseau façonnée ?
La Fable apparaît-elle à nos yeux décevants ?
L'antique Eole a-t-il jeté son outre aux vents ?
De sorte qu'en ce gouffre où les orages naissent,
Les vents, subitement domptés, la reconnaissent !
Est-ce l'aimant qui s'est fait aider par l'éclair
Pour bâtir un esquif céleste avec de l'air ?
Du haut des clairs azurs vient-il une visite ?
Est-ce un transfiguré qui part et ressuscite,
Qui monte, délivré de la terre, emporté
Sur un char volant fait d'extase et de clarté,
Et se rapproche un peu par instant, pour qu'on voie,
Du fond du monde noir, la fuite de sa joie ?

Ce n'est pas un morceau d'une cime ; ce n'est
Ni l'outre où tout le vent de la Fable tenait ;
Ni le jeu de l'éclair ; ce n'est pas un fantôme
Venu des profondeurs aurorales du dôme ;
Ni le rayonnement d'un ange qui s'en va,
Hors de quelque tombeau béant, vers Jéhovah.
Ni rien de ce qu'en songe ou dans la fièvre on nomme.
Qu'est-ce que ce navire impossible ? C'est l'homme.

C'est la grande révolte obéissante à Dieu !
La sainte fausse clef du fatal gouffre bleu !
C'est Isis qui déchire éperdument son voile !
C'est du métal, du bois, du chanvre et de la toile,
C'est de la pesanteur délivrée, et volant ;
C'est la force alliée à l'homme étincelant,
Fière, arrachant l'argile à sa chaîne éternelle ;
C'est la matière, heureuse, altière, ayant en elle

De l'ouragan humain, et planant à travers
L'immense étonnement des cieux enfin ouverts.

Audace humaine ! effort du captif ! sainte rage !
Effraction enfin plus forte que la cage !
Que faut-il à cet être, atome au large front,
Pour vaincre ce qui n'a ni fin, ni bord, ni fond,
Pour dompter le vent, trombe, et l'écume, avalanche ?
Dans le ciel une toile et sur mer une planche.

*

Jadis des quatre vents la fureur triomphait ;
De ces quatre chevaux échappés l'homme a fait
L'attelage de son quadrige ;
Génie, il les tient tous dans sa main, fier cocher
Du char aérien que l'éther voit marcher ;
Miracle, il gouverne un prodige.

Char merveilleux ! son nom est Délivrance. Il court.
Près de lui le ramier est lent, le flocon lourd ;
Le daim, l'épervier, la panthère,
Sont encor là, qu'au loin son ombre a déjà fui ;
Et la locomotive est reptile, et, sous lui,
L'hydre de flamme est ver de terre.

Une musique, un chant, sort de son tourbillon.
Ses cordages vibrants et remplis d'aquilon
Semblent, dans le vide où tout sombre,
Une lyre à travers laquelle par moment
Passe quelque âme en fuite au fond du firmament
Et mêlée aux souffles de l'ombre.

Car l'air, c'est l'hymne épars ; l'air, parmi les récifs
Des nuages roulant en groupes convulsifs,
Jette mille voix étouffées ;
Les fluides, l'azur, l'effluve, l'élément,
Sont toute une harmonie où flottent vaguement
On ne sait quels sombres Orphées.

Superbe, il plane, avec un hymne en ses agrès ;
Et l'on croit voir passer la strophe du progrès.
Il est la nef, il est le phare !
L'homme enfin prend son sceptre et jette son bâton.
Et l'on voit s'envoler le calcul de Newton
Monté sur l'ode de Pindare.

Le char haletant plonge et s'enfonce dans l'air,
Dans l'éblouissement impénétrable et clair,
Dans l'éther sans tache et sans ride ;
Il se perd sous le bleu des cieux démesurés ;
Les esprits de l'azur contemplent effarés
Cet engloutissement splendide.

Il passe, il n'est plus là ; qu'est-il donc devenu ?
Il est dans l'invisible, il est dans l'inconnu ;
Il baigne l'homme dans le songe,
Dans le fait, dans le vrai profond, dans la clarté,
Dans l'océan d'en haut plein d'une vérité
Dont le prêtre a fait un mensonge.

Le jour se lève, il va ; le jour s'évanouit,
Il va ; fait pour le jour, il accepte la nuit.
Voici l'heure des feux sans nombre ;
L'heure où, vu du nadir, ce globe semble, ayant
Son large cône obscur sous lui se déployant,
Une énorme comète d'ombre.

La brume redoutable emplit au loin les airs.
Ainsi qu'au crépuscule on voit, le long des mers,
Le pêcheur, vague comme un rêve,
Traînant, dernier effort d'un long jour de sueurs,
Sa nasse où les poissons font de pâles lueurs,
Aller et venir sur la grève.

La Nuit tire du fond des gouffres inconnus
Son filet où luit Mars, où rayonne Vénus,
Et, pendant que les heures sonnent,
Ce filet grandit, monte, emplit le ciel des soirs,
Et dans ses mailles d'ombre et dans ses réseaux noirs
Les constellations frissonnent.

L'aéroscaphe suit son chemin ; il n'a peur
Ni des piéges du soir, ni de l'âcre vapeur,
Ni du ciel morne où rien ne bouge,
Où les éclairs, luttant au fond de l'ombre entre eux,
Ouvrent subitement dans le nuage affreux
Des cavernes de cuivre rouge.

Il invente une route obscure dans les nuits ;
Le silence hideux de ces lieux inouïs
N'arrête point ce globe en marche ;
Il passe, portant l'homme et l'univers en lui ;
Paix ! gloire ! et, comme l'eau jadis, l'air aujourd'hui
Au-dessus de ses flots voit l'arche.

Le saint navire court par le vent emporté
Avec la certitude et la rapidité
Du javelot cherchant la cible ;
Rien n'en tombe, et pourtant il chemine en semant ;
Sa rondeur, qu'on distingue en haut confusément,
Semble un ventre d'oiseau terrible.

Il vogue ; les brouillards sous lui flottent dissous ;
Ses pilotes penchés regardent, au-dessous
Des nuages où l'ancre traîne,
Si, dans l'ombre, où la terre avec l'air se confond,
Le sommet du Mont-Blanc ou quelque autre bas-fond
Ne vient pas heurter sa carène.

*

La vie est sur le pont du navire éclatant.
Le rayon l'envoya, la lumière l'attend.
L'homme y fourmille, l'homme invincible y flamboie ;
Point d'armes ; un fier bruit de puissance et de joie ;
Le cri vertigineux de l'exploration !
*Il court, ombre, clarté, chimère, vision !*
*Regardez-le pendant qu'il passe, il va si vite !*

*Comme autour d'un soleil un système gravite,*
Une sphère de cuivre énorme fait marcher
Quatre globes où pend un immense plancher ;
Elle respire et fuit dans les vents qui la bercent ;
Un large et blanc hunier horizontal, que percent
Des trappes, se fermant, s'ouvrant au gré du frein,
Fait un grand diaphragme à ce poumon d'airain ;
Il s'impose à la nue ainsi qu'à l'onde un liége ;
La toile d'araignée humaine, un vaste piége
De cordes et de nœuds, un enchevêtrement
De soupapes que meut un câble où court l'aimant,
Une embûche de treuils, de cabestans, de moufles,
Prend au passage et fait travailler tous les souffles ;

L'esquif plane, encombré d'hommes et de ballots,
Parmi les arc-en-ciel, les azurs, les halos,
Et sa course, écheveau qui sans fin se dévide,
A pour point d'appui l'air et pour moteur le vide;
Sous le plancher s'étage un chaos régulier
De ponts flottants que lie un tremblant escalier;
Ce navire est un Louvre errant avec son faste;
Un fil le porte; il fuit, léger, fier, et si vaste,
Si colossal, au vent du grand abîme clair,
Que le Léviathan, rampant dans l'âpre mer,
A l'air de sa chaloupe aux ténèbres tombée,
Et semble, sous le vol d'un aigle, un scarabée
Se tordant dans le flot qui l'emporte, tandis
Que l'immense oiseau plane au fond d'un paradis.

Si l'on pouvait rouvrir les yeux que le ver ronge,
Oh! ce vaisseau, construit par le chiffre et le songe,
Éblouirait Shakspeare et ravirait Euler!
Il voyage, Délos gigantesque de l'air,
Et rien ne le repousse et rien ne le refuse;
Et l'on entend parler sa grande voix confuse.

Par moments la tempête accourt, le ciel pâlit,
L'autan, bouleversant les flots de l'air, emplit
L'espace d'une écume affreuse de nuages;
Mais qu'importe à l'esquif de la mer sans rivages!
Seulement, sur son aile il se dresse en marchant;
Il devient formidable à l'abîme méchant,
Et dompte en frémissant la trombe qui se creuse.
On le dirait conduit dans l'horreur ténébreuse
Par l'âme des Leibnitz, des Fultons, des Képlers;
Et l'on croit voir, parmi le chaos plein d'éclairs,
De détonations, d'ombre et de jets de soufre,
Le sombre emportement d'un monde dans un gouffre.

*

Qu'importe le moment! qu'importe la saison!
La brume peut cacher dans le blême horizon
Les Saturnes et les Mercures;
La bise, conduisant la pluie aux crins épars,
Dans les nuages lourds grondant de toutes parts,
Peut tordre des hydres obscures;

Qu'importe! il va. Tout souffle est bon; simoun, mistral!
La terre a disparu dans le puits sidéral.
Il entre au mystère nocturne;
Au-dessus de la grêle et de l'ouragan fou,
Laissant le globe en bas dans l'ombre, on ne sait où,
Sous le renversement de l'urne.

Intrépide, il bondit sur les ondes du vent;
Il se rue, aile ouverte et la proue en avant,
Il monte, il monte, il monte encore,
Au delà de la zone où tout s'évanouit,
Comme s'il s'en allait dans la profonde nuit
A la poursuite de l'aurore!

Calme, il monte où jamais nuage n'est monté;
Il plane à la hauteur de la sérénité,
Devant la vision des sphères;
Elles sont là, faisant le mystère éclatant,
Chacune feu d'un gouffre, et toutes constatant
Les énigmes par les lumières.

Andromède étincelle, Orion resplendit;
L'essaim prodigieux des Pléiades grandit;
Sirius ouvre son cratère;
Arcturus, oiseau d'or, scintille dans son nid;
Le Scorpion hideux fait cabrer au zénith
Le poitrail bleu du Sagittaire.

L'aéroscaphe voit, comme en face de lui,
Là-haut, Aldébaran par Céphée ébloui,
Persée, escarboucle des cimes,
Le chariot polaire aux flamboyants essieux,
Et, plus loin, la lueur lactée, ô sombres cieux,
La fourmilière des abîmes!

Vers l'apparition terrible des soleils,
Il monte; dans l'horreur des espaces vermeils,
Il s'oriente, ouvrant ses voiles;
On croirait, dans l'éther où de loin on l'entend,
Que ce vaisseau puissant et superbe, en chantant,
Part pour une de ces étoiles!

Tant cette nef, rompant tous les terrestres nœuds,
Volante, et franchissant le ciel vertigineux,
Rêve des blêmes Zoroastres,
Comme effrénée au souffle insensé de la nuit,
Se jette, plonge, enfonce et tombe et roule et fuit
Dans le précipice des astres!

*

Où donc s'arrêtera l'homme séditieux?
L'espace voit, d'un œil par moment soucieux,
L'empreinte du talon de l'homme dans les nues;
Il tient l'extrémité des choses inconnues;
Il épouse l'abîme à son argile uni;
Le voilà maintenant marcheur de l'infini.
Où s'arrêtera-t-il, le puissant réfractaire?
Jusqu'à quelle distance ira-t-il de la terre?
Jusqu'à quelle distance ira-t-il du destin?
L'âpre Fatalité se perd dans le lointain;
Toute l'antique histoire affreuse et déformée
Sur l'horizon nouveau fuit comme une fumée.
Les temps sont venus. L'homme a pris possession
De l'air, comme du flot la grêbe et l'alcyon.
Devant nos rêves fiers, devant nos utopies
Ayant des yeux croyants et des ailes impies,
Devant tous nos efforts pensifs et haletants,
L'obscurité sans fond fermait ses deux battants;
Le vrai champ enfin s'offre aux puissantes algèbres;
L'homme vainqueur, tirant le verrou des ténèbres,
Dédaigne l'Océan, le vieil infini mort.
La porte noire cède et s'entre-bâille. Il sort!

O profondeurs! faut-il encor l'appeler l'homme?

L'homme est d'abord monté sur la bête de somme;
Puis sur le chariot que portent des essieux;
Puis sur la frêle barque au mât ambitieux;
Puis, quand il a fallu vaincre l'écueil, la lame,
L'onde et l'ouragan, l'homme est monté sur la flamme;
A présent l'immortel aspire à l'éternel;
Il montait sur la mer, il monte sur le ciel.

L'homme force le sphinx à lui tenir la lampe.
Jeune, il jette le sac du vieil Adam qui rampe,
Et part, et risque aux cieux, qu'éclaire son flambeau,
Un pas semblable à ceux qu'on fait dans le tombeau;
Et peut-être voici qu'enfin la traversée
Effrayante, d'un astre à l'autre, est commencée!

*

Stupeur ! se pourrait-il que l'homme s'élançât ?
O nuit ! se pourrait-il que l'homme, ancien forçat,
Que l'esprit humain, vieux reptile,
Devînt ange, et, brisant le carcan qui le mord,
Fût soudain de plain-pied avec les cieux ? La mort
Va donc devenir inutile !

Oh ! franchir l'éther ! songe épouvantable et beau !
Doubler le promontoire énorme du tombeau !
Qui sait ? Toute aile est magnanime :
L'homme est ailé. Peut-être, ô merveilleux retour !
Un Christophe Colomb de l'ombre, quelque jour,
Un Gama du cap de l'abîme,

Un Jason de l'azur, depuis longtemps parti,
De la terre oublié, par le ciel englouti,
Tout à coup, sur l'humaine rive
Reparaîtra, monté sur cet alérion,
Et montrant Sirius, Allioth, Orion,
Tout pâle, dira : J'en arrive !

Ciel ! ainsi, comme on voit aux voûtes des celliers
Les noirceurs qu'en rôdant tracent les chandeliers,
On pourrait, sous les bleus pilastres,
Deviner qu'un enfant de la terre a passé,
A ce que le flambeau de l'homme aurait laissé
De fumée au plafond des astres !

*

Pas si loin ! pas si haut ! redescendons. Restons
L'homme, restons Adam ; mais non l'homme à tâtons,
Mais non l'Adam tombé ! Tout autre rêve altère
L'espèce d'idéal qui convient à la terre.
Contentons-nous du mot : meilleur ! écrit partout.
Oui, l'aube s'est levée.

Oh ! ce fut tout à coup
Comme une éruption de folie et de joie,
Quand, après six mille ans dans la fatale voie,
Défaite brusquement par l'invisible main,
La pesanteur, liée au pied du genre humain,
Se brisa, cette chaîne était toutes les chaînes !
Tout s'envola dans l'homme, et les fureurs, les haines !
Les chimères, la force évanouie enfin,
L'ignorance et l'erreur, la misère et la faim,
Le droit divin des rois, les faux dieux juifs ou guèbres,
Le mensonge, le dol, les brumes, les ténèbres,
Tombèrent dans la poudre avec l'antique sort,
Comme le vêtement du bagne dont on sort.

Et c'est ainsi que l'ère annoncée est venue,
Cette ère qu'à travers les temps, épaisse nue,
Thalès apercevait au loin devant ses yeux ;
Et Platon, lorsque, ému, des sphères dans les cieux
Il écoutait les chants et contemplait les danses.

Les êtres inconnus et bons, les providences
Présentes dans l'azur où l'œil ne les voit pas,
Les anges qui de l'homme observent tous les pas,
Leur tâche sainte étant de diriger les âmes,
Et d'attiser, avec toutes les belles flammes,
La conscience au fond des cerveaux ténébreux,
Ces amis des vivants, toujours penchés sur eux,
Ont cessé de frémir, et d'être, en la tourmente
Et dans les sombres nuits, la voix qui se lamente.
Voici qu'on voit bleuir l'idéale Sion.
Ils n'ont plus l'œil fixé sur l'apparition
Du vainqueur, du soldat, du fauve chasseur d'hommes.
Les vagues flamboiements épars sur les Sodomes,
Précurseurs du grand feu dévorant, les lueurs
Que jette le sourcil tragique des tueurs,
Les guerres, s'arrachant avec leur griffe immonde
Les frontières, haillon difforme du vieux monde,
Les battements de cœur des mères aux abois,
L'embuscade ou le vol guettant au fond des bois,
Le cri de la chouette et de la sentinelle,
Les fléaux, ne sont plus leur alarme éternelle.
Le deuil n'est plus mêlé dans tout ce qu'on entend ;
Leur oreille n'est plus tendue à chaque instant
Vers le gémissement indigné de la tombe ;
La moisson rit aux champs où râlait l'hécatombe ;
L'azur ne les voit plus pleurer les nouveau-nés,
Dans tous les innocents pressentir des damnés,
Et la pitié n'est plus leur unique attitude ;
Ils ne regardent plus la morne servitude
Tresser sa maille obscure à l'osier des berceaux.
L'homme aux fers, pénétré du frisson des roseaux,
Est remplacé par l'homme attendri, fort et calme ;
La fonction du sceptre est faite par la palme ;
Voici qu'enfin, ô gloire ! exaucés dans leur vœu,
Ces êtres, dieux pour nous, créatures pour Dieu,
Sont heureux, l'homme est bon, et sont fiers, l'homme est juste ;
Les esprits purs, essaim de l'empyrée auguste,
Devant ce globe obscur qui devient lumineux,
Ne sentent plus saigner l'amour qu'ils ont en eux ;
Une clarté paraît dans leur beau regard sombre ;
Et l'archange commence à sourire dans l'ombre.

*

Où va-t-il ce navire ? Il va, de jour vêtu,
A l'avenir divin et pur, à la vertu,
A la science qu'on voit luire,
A la mort des fléaux, à l'oubli généreux,
A l'abondance, au calme, au rire, à l'homme heureux ;
Il va, ce glorieux navire,

Au droit, à la raison, à la fraternité,
A la religieuse et sainte vérité
Sans impostures et sans voiles,
A l'amour, sur les cœurs serrant son doux lien,
Au juste, au grand, au bon, au beau. . . .—Vous voyez bien
Qu'en effet il monte aux étoiles !

Il porte l'homme à l'homme et l'esprit à l'esprit.
Il civilise, ô gloire ! Il ruine, il flétrit
Tout l'affreux passé qui s'effare,
Il abolit la loi de fer, la loi de sang,
Les glaives, les carcans, l'esclavage, en passant
Dans les cieux comme une fanfare.

Il ramène au vrai ceux que le faux repoussa :
Il fait briller la foi dans l'œil de Spinosa
Et l'espoir sur le front de Hobbe ;
Il plane, rassurant, réchauffant, épanchant
Sur ce qui fut lugubre et ce qui fut méchant
Toute la clémence de l'aube.

Les vieux champs de bataille étaient là dans la nuit ;
Il passe, et maintenant voilà le jour qui luit
Sur ces grands charniers de l'histoire
Où les siècles, penchant leur œil triste et profond,
Venaient regarder l'ombre effroyable que font
Les deux ailes de la victoire.

Derrière lui, César redevient homme ; Éden
S'élargit sur l'Érèbe, épanoui soudain ;
Les ronces de lys sont couvertes ;
Tout revient, tout renaît ; ce que la mort courbait
Refleurit dans la vie, et le bois du gibet
Jette, effrayé, des branches vertes.

Le nuage, l'aurore aux candides fraîcheurs,
L'aile de la colombe, et toutes les blancheurs,
Composent là-haut sa magie ;
Derrière lui, pendant qu'il fuit vers la clarté,
Dans l'antique noirceur de la Fatalité
Des lueurs de l'enfer rougie,

Dans ce brumeux chaos qui fut le monde ancien,
Où l'Allah turc s'accoude au sphinx égyptien,
Dans la séculaire géhenne,
Dans la Gomorrhe infâme où flambe un lac fumant,
Dans la forêt du mal qu'éclairent vaguement
Les deux yeux fixes de la Haine,

Tombent, sèchent, ainsi que des feuillages morts,
Et s'en vont la douleur, le péché, le remords,
La perversité lamentable,
Tout l'ancien joug, de rêve et de crime forgé,
Nemrod, Aaron, la guerre avec le préjugé,
La boucherie avec l'étable !

Tous les spoliateurs et tous les corrupteurs
S'en vont ; et les faux jours sur les fausses hauteurs ;
Et le taureau d'airain qui beugle,
La hache, le billot, le bûcher dévorant,
Et le docteur versant l'erreur à l'ignorant,
Vil bâton qui trompait l'aveugle !

Et tous ceux qui faisaient, au lieu de repentirs,
Un rire au prince avec les larmes des martyrs,
Et tous ces flatteurs des épées
Qui louaient le sultan, le maître universel,
Et, pour assaisonner l'hymne, prenaient du sel
Dans le sac aux têtes coupées !

Les pestes, les forfaits, les cimiers fulgurants,
S'effacent, et la route où marchaient les tyrans,
Bélial roi, Dagon ministre,
Et l'épine, et la haie horrible du chemin
Où l'homme, du vieux monde et du vieux vice humain,
Entend bêler le bouc sinistre.

On voit luire partout les esprits sidéraux ;
On voit la fin du monstre et la fin du héros,
Et de l'athée et de l'augure,
La fin du conquérant, la fin du paria ;
Et l'on voit lentement sortir Beccaria
De Dracon qui se transfigure.

On voit l'agneau sortir du dragon fabuleux,
La vierge de l'opprobre, et Marie aux yeux bleus
De la Vénus prostituée ;
Le blasphème devient le psaume ardent et pur,
L'hymne prend, pour s'en faire autant d'ailes d'azur,
Tous les haillons de la huée.

Tout est sauvé ! la fleur, le printemps aromal,
L'éclosion du bien, l'écroulement du mal,
Fêtent dans sa course enchantée
Ce beau globe éclaireur, ce grand char curieux,
Qu'Empédocle, du fond des gouffres, suit des yeux,
Et, du haut des monts, Prométhée !

Le jour s'est fait dans l'antre où l'horreur s'accroupit.
En expirant, l'antique univers décrépit,
Larve à la prunelle ternie,
Gisant, et regardant le ciel noir s'étoiler,
A laissé cette sphère heureuse s'envoler
Des lèvres de son agonie.

*

Oh ! ce navire fait le voyage sacré !
C'est l'ascension bleue à son premier degré ;
Hors de l'antique et vil décombre,
Hors de la pesanteur, c'est l'avenir fondé ;
C'est le destin de l'homme à la fin évadé,
Qui lève l'ancre et sort de l'ombre !

Ce navire là-haut conclut le grand hymen.
Il mêle presque à Dieu l'âme du genre humain.
Il voit l'insondable, il y touche ;
Il est le vaste élan du progrès vers le ciel ;
Il est l'entrée altière et sainte du réel
Dans l'antique idéal farouche.

Oh ! chacun de ses pas conquiert l'illimité !
Il est la joie ; il est la paix ; l'humanité
A trouvé son organe immense ;
Il vogue, usurpateur sacré, vainqueur béni,
Reculant chaque jour plus loin dans l'infini
Le point sombre où l'homme commence.

Il laboure l'abîme ; il ouvre ces sillons
Où croissaient l'ouragan, l'hiver, les tourbillons,
Les sifflements et les huées ;
Grâce à lui, la concorde est la gerbe des cieux ;
Il va, fécondateur du ciel mystérieux,
Charrue auguste des nuées.

Il fait germer la vie humaine dans ces champs
Où Dieu n'avait encor semé que des couchants
Et moissonné que des aurores ;
Il entend, sous son vol qui fend les airs sereins,
Croître et frémir partout les peuples souverains,
Ces immenses épis sonores !

Nef magique et suprême ! elle a, rien qu'en marchant,
Changé le cri terrestre en pur et joyeux chant,
Rajeuni les races flétries,
Établi l'ordre vrai, montré le chemin sûr,
Dieu juste ! et fait entrer dans l'homme tant d'azur
Qu'elle a supprimé les patries !

Faisant à l'homme avec le ciel une cité,
Une pensée avec toute l'immensité,
Elle abolit les vieilles règles,
Elle abaisse les monts, elle annule les tours ;
Splendide, elle introduit les peuples, marcheurs lourds,
Dans la communion des aigles.

Elle a cette divine et chaste fonction
De composer là-haut l'unique nation,
A la fois dernière et première,
De promener l'essor dans le rayonnement,
Et de faire planer, ivre de firmament,
La liberté dans la lumière.

A GLIMPSE OF THE FUTURE.

The Future—the last evangel, which has included all others. *Its* cathedral the dome of immensity, hast thou seen it? Coped with the star galaxies; paved with the green mosaic of land and ocean; and for altar, verily, the star-throne of the Eternal! Its litany and psalmody, the noble arts, the heroic work and suffering, and true heart-utterance of all the valiant of the sons of men. Its choir-music, the ancient winds and oceans, and deep-toned, inarticulate, but most speaking voices of destiny and history, supernal ever as of old between two great Silences:

> Stars silent rest o'er us,
> Graves under us silent.
>
> CARLYLE.

## V.

Some imagine that they can perceive the foretelling of the great change which may be caused by the science of Aerostation in the inspired words of the Holy Scriptures, and that it is foreshadowed in the vision of Ezekiel, or in the sublime strains of Isaiah:—

> "WHO ARE THESE THAT FLY AS A CLOUD, AND AS DOVES TO THEIR WINDOWS?"—lx. 8.

A recent writer has directed public attention to the resemblance between the description of the Leviathan in the Book of Job, and the iron-plated vessels of war now constructed by

so many nations. We should remember, however, that the Holy Bible was not intended for the instruction of man in the various sciences; but that these subjects were wisely given him for the exercise of his intellectual faculties, and the use of that reason with which it has pleased the Almighty to endow the noblest work of this Creation.

The Bible, we know, was the gift of God, in His unspeakable love and mercy, to the unlearned as well as to the learned, in order to reveal to man the plan of redemption, and that which can alone give peace and contentment in his last hours,—the blessed assurance of everlasting life, through the merits and mediation of his Saviour.

Now safely moored, my perils o'er,
I'll sing, first in night's diadem,
For ever, and for evermore,
The Star! the Star of Bethlehem!

ANGEL AND CHILD.

Down thither prone in flight,
He speeds, and through the vast ethereal sky
Sails between world and world with steady wings:
Now on the polar winds, then with quick fan
Winnows the buxom air.

MILTON.

# APPENDIX.

THE PASSIVE AIR UPBORE
THEIR NIMBLE TREAD: AS WHEN THE TOTAL KIND
OF BIRDS, IN ORDERLY ARRAY ON WING,
CAME SUMMONED OVER EDEN TO RECEIVE
THEIR NAMES OF THEE: SO OVER MANY A TRACT
OF HEAVEN THEY MARCHED, AND MANY A PROVINCE WIDE,
TENFOLD THE LENGTH OF THIS TERRENE.

MILTON.

# APPENDIX.

## I.

THE following roll of all known Aeronauts was compiled by Depuis Delcourt, in 1829, augmented by Monck Mason, in 1838, and revised by Depuis Delcourt in his 'Manuel d'Aerostation,' in 1849. I have not added to it, as since that year the numbers have increased by thousands, but I think the names of the first five hundred experimenters who ascended in such fragile barks as balloons will prove interesting when this science shall have attained its development. The percentage of accidents, and the characters of the nations forming our present Commonwealth, as shown by the following figures, are not without interest.

The number given by Monck Mason is 471, and the proportions among the different nations is as follows:—

| | | | | | |
|---|---|---|---|---|---|
| English | 313 | French | 104 | Italians | 18 |
| Germans | 17 | Turks, | 5 | Prussians | 3 |
| N. Americans | 3 | Russians | 2 | Poles | 2 |
| Hungarians | 2 | Danes | 1 | Swiss | 1 |

Among these are to be found the names of 49 ladies—of whom 28 are English, 17 French, 3 Germans, and 1 Italian. Out of several thousand ascents (Green alone made 249, and other members of his family 535), only *nine* lives have been lost, and these casualties were owing to the following causes:—Five, viz., MM. Pilâtre de Rozier, Romain, Olivari, Bittorff, and Zambeccari, to the inherent perils of the Montgolfière; one, Madame Blanchard, to the fireworks she was exhibiting: the other three—Mr. Harris, to ignorance of the art; M. Mosment, to bravado on a platform; and Mr. Windham Sadler, to the extreme roughness of the weather.

M. Depuis Delcourt gives 504 aeronauts down to the year 1848, with *ten* casualties; as, to the list just given, is added the name of Mr. Cocking. They are marked * in the following list:—

### ROLL OF THE FIRST 500 AERONAUTS, WITH THE DATE AND PLACE OF THEIR FIRST ASCENTS.

#### 1783.

ARLANDES (Marquis d'), Major in the Garde Royale. La Muette, near Paris.
CHARLES, Professor of Natural Philosophy. Paris.
ROBERT, mechanic-engineer. Paris.
*PILÂTRE DE ROSIER, Professor of Natural Philosophy. Paris.
WILCOX (James), carpenter. Philadelphia. *First ascent in America.*

#### 1784.

ADORN, optician. Strasbourg.
ANDRÉANI (Cavalier Paolo). Milan, 25th February. *First ascent in Italy.*
BAZZAGO (Giuseppe). Milan.
BERTRAND (Abbé), Professor of Natural Philosophy. Dijon.
BLANCHARD (J. P.), mechanic. Paris. Made 66 ascents.
BOBY, Registrar to the Provincial Parliament. Rouen.
BOUCHE, painter. Aranjuez, Spain.
BRÉMOND, merchant. Marseilles.
BRUN. Chambéry.
CARNUS (Abbé), Professor of Philosophy. Rhodez.
CHALFOUR, architect. Bordeaux.
CHARTRES (Duc de), afterwards Duke of Orleans. Saint Cloud.
COLLIN-HULLIN. Paris.
COUSTARD DE MASSY, Lieutenant-General. Nantes.
DAMPIERRE (Comte de), Officer of the Guards. Lyons.
DARBELET, Professor of Natural Philosophy. Bordeaux.
DELUYNES, merchant. Nantes.
DESGRANGES. Bordeaux.
FLEURAND, ship-painter. Lyons.
FONTAINE (C. G.), merchant. Lyons.
GABRIEL. Strasbourg.
GERLI (Augustin), architect. Milan.
GÉRLI (Charles Joseph), architect. Milan.
GUYTON-DE-MORVEAU, chemist. Dijon.
HAGMULLER (Daniel). Vienna.
HAMMERSMITH (George). Vienna.
JEFFERIES (J.), an American doctor. London.
LAPORTE D'ANGLEFORT (Comte), Lieutenant Colonel of Artillery, Lyons.

LAURENCIN Comte de), a Corresponding Member of the Academy. Lyons.
LOUCHET, Professor "de belles-lettres." Rhodez.
LIGNE (Prince Charles de). Lyons.
LUNARDI (V.), Attaché to the Neapolitan Embassy. Moorfields, London. 15th September. *First ascent in England.*
MAITRE (Chevalier), in the French Navy. Chambéry.
MARET. Marseilles.
MONTGOLFIER (Joseph), one of the inventors of the aerostat. Lyons.
MOUCHET, Professor of Natural Sciences. Nantes.
PIERRE. Strasburg.
PROUST, Professor of Chemistry. Versailles.
RAMBANT. Aix.
RAPHINE. Brenttord.
RIVIERRE. Near Paris.
ROBERT, mechanical engineer. Paris.
ROSSI (Gaetano). Milan.
ROUSSEAU. Navan.
SADLER (James). Oxford, 12th October. *The first English aeronaut.*
SCHMALTZ (Michel), Vienna.
SHELDON, Professor of Anatomy; 16th October. Chelsea.
STUVER (Gaspard). Vienna.
THIBLE (Madame). Lyons. *The first Lady in a free ascent.*
TYTLER (James), August 27th. Edinburgh. *The first in Great Britain.*
VIRLY (de), President of Exchequer Committee. Dijon.
*ZAMBECCARI (Count F.). London.

1785.

ALBAN, chemist. Vavelle, near Paris.
ARNOLD. London.
BALDWIN, doctor. Chester.
BIGGINS. London.
BINN. Halifax.
BLAKE (Captain). London.
CHAPPE (Abbé). Javelle.
CROSBIE. Dublin. *First ascent in Ireland.*
CUBIERES (Marquis de). Javelle.
DAVY. Beccles.
DECKER. Norwich.
DECKER (jun.). Bristol.
D'HONNINETUM. The Hague.
FITZPATRICK (Colonel). Oxford.
FRENCH (Lieutenant). Chester.
FROBISHER. Halifax.
HARPER. Birmingham.
HINES (Miss). Beccles.
L'EEINARD (Chevalier de). Lille.
LOCKWOOD. London.
LUZARCHE (Madame de). Jávelle.
MAGUIRE (Sir Richard). Dublin. Knighted for this exploit.
MONEY (Major, afterwards General). London.
NARBONNE (Comte de). Javelle.
NEWMARCH. Halifax.
POOLE. Bury-St.-Edmunds.
POTAIN (Dr.), surgeon, R.N. Dublin.
PUIMOUN (Baron de). Javelle.
*ROMAINE. Boulogne.
ROUTH (Dr.). Beccles.
SADLER (John). Worcester.
SAGE (Mrs.). London. *The first English Lady*, 29th June, 1782.
SIMONET (Madlle.). London (3rd of May), aged 14½. *This French lady was the first lady to ascend in Great Britain.*
SIMONET (Mdlle.), 21st May. London.
TRUCHOU, carpenter. Javelle, near Paris.
VALLET, manufacturer of chemicals. Javelle.
VERNON (Admiral Sir Edward). London.
WINDHAM (Right Hon. W.). Moulsey-Hurst, Surrey. *The first M.P. to ascend.*

1786.

REDMAN. London.
SAINTE-CROIX. Salisbury.
TESTU-BRISSY. Paris.

1788.

TUMMERMAUS (Mademoiselle de). Metz.

1790.

GARNERIN (André-Jacques). Paris. *He made 50 ascents and was the first aeronaut who descended in a parachute in* 1797.
IBRAIM, Turkish Pacha. Warsaw, 14th May.
LALLEMAND DE SAINTE-CROIX (Marquis). Paris.
POTOSKY (Comte J.). Warsaw, 14th May.
STERNBERG (Comte de Joachim), President of the Academy. Prague.

1792.

BLANCHARD (the younger). Lubeck.
CHASOT (Comtesse de). Lubeck.

1798.

BEAUVAIS, Aide-de-camp. Paris.
GARNERIN (Madame). Paris.
HENRI (Madlle Célestine). Paris.
PUGH, chemist, Rouen.

1799.

DE LALANDE (Jérôme), astronomer. Paris.
MAISON (Madlle.). Paris.

1800.

DERME (Madlle. Fanchette). Paris.

1801.

BÉCHET. Rennes.
BUCHET DU CHATELIER. Rennes.
JOLEIN, exchanger. Paris.
LOLLAND. Paris.
LUGGIERI (Claude), builder. Paris.
PARIN. Rennes.

1802.

ACARD, builder. Paris.
BARLY. Constantinople.
BROWN. London.
DEVIGNE. Constantinople.
GLASFORD. London.
LOCKER (Edward Hawke). London.
*OLIVARI. Orleans.
SNOWDEN (Captain). London.

1803.

ANDRÉOLE (Pascal), doctor. Bologna.
AUBERT. Moscow.
GAERTNER (Herr). Berlin.
GOSSY. Valoynes.
GRASSETTI, doctor. Bologna.
L'HOEST, merchant, Hamburg.
LUWOFF, Russian General. St. Petersburg.
*MOSMENT. Rouen.
ROBERTSON (E. G. R.). Hamburgh.
TRAITEUR (Lieutenant-Colonel). Carlsruhe.

1804.

ALEXANDRE (Mons.). St. Petersburg.
BIOT (J. B.). Professor of Natural Philosophy and Astronomy at the "College de France." Paris.

*BLANCHARD (Madame). Marseilles.
BOLLE (Aimé). Paris.
GAY-LUSSAC, Professor of Chemistry at the "College de France." Paris. *First ascent for meteorological experiments.*
GIARD. Lyons.
MICHAUX. Vienna.
PAULZ, ex-officer of the Swiss Artillery. Paris.
TOUCHENINOFF (Madame). Moscow.
ZACCHAROF. St. Petersburg.

1805.

AUGUSTIN (A. Dubourg). Rouen.
JUNGIUS (W.), Professor of Natural Philosophy at the College Frederick-William, Berlin.
LEMERCIER (H.), manufacturer of chemicals. Paris.

1806.

KŒLS, student. Berlin.

1807.

*BITTORFF (Herr), mechanic. Mannheim.

1808.

BRIOSCHI (Signor). Padua.
DEGEN (Jacob), clock-maker. Vienna.
KUPARENTO (Jordarki). Warsaw (24th July). This Pole's balloon caught fire, but he descended safely in a Parachute.

1809.

DOUMERE (Baron).
HUTCHINSON (Miss).
MARCHESELLI (Antonio). Ferrara.

1810.

CLAYFIELD. Bristol.
CLAUDIUS (Herr), manufacturer of glazed cloth. Berlin.
PAGET (Lieutenant). London.
REICHARD (Charles-Godfrey). Berlin.

1811.

BEAUFOY (H.). London.
BURCHAM (J.). Birmingham.
COLDING (Herr). Copenhagen.
REICHARD (Madlle. Wilhelmine). Berlin.
ROBERTSON (Madame). Vienna.
SILVESTRINI (Philippo). Florence.

1812.

BONAGA (Signor). Bologna.
KRASKEWIL (Herr), doctor, Vienna.
MENNER. Vienna.

1813.

CAMERON. Glasgow.

1814.

*SADLER (Windham) London.
THOMPSON (Miss). London.

1815.

GARNERIN (Madlle. Elisa). Paris.

1816.

GARNERIN (Eugénie). Paris.
LIVINGSTON. Dublin.
MICHELET DE BEAUJEU (Madlle. Lise). Paris.

1817.

GONDAMIN, merchant. Lyons.
MARGAT. Paris.
PUKLER-MUSKAU (The Prince Herman). Berlin.

1818.

BENOIST (Madlle. Cécile). Paris.
BLANCHE, N. Madlle.). Paris.
GUILLIE (Charles). Bordeaux.
MARGAT (Madame). Paris.
NANCY (Madlle.). Bordeaux.

1819.

ROBERTSON (Eugène). Lisbon.

1821.

FASSY (A.), agent. Marseilles.
GREEN (Charles). London. Has made 526 ascents without any serious accident) '*and was the first to use coal gas.*'

1822.

GRIFFITHS. Cheltenham.
JULLIEN (Madlle. Thérèse-Aglaé). Marseilles.

1823.

COSSOUL (Madame Virginie). Seville.
GRAHAM. London.
*HARRIS (Lieutenant, R.N.) London.
ROBERTSON (Auguste-Dimitri). Seville.
SIMMONDS (H.). Reading.
SPARROW. Oxford.
WEBB. Bath.

1824.

ADAMS (J.) Bath.
BEAUFOY (Captain). Islington.
BEER. Canterbury.
BRADLEY (Miss). Warwick.
BROOKES. Coventry.
CLARKE. Wolverhampton.
CULLUM (R.). Exeter.
DONELLY (J.). Bolton.
DUPUIS-DELCOURT, Editor of a Parisian Paper. Montjean. *The founder of the Aerostatic and Meteorological Society of France.* He died in April, 1864, and Nadar gives a touching "Oraison Funèbre" in the Preface to the 'Mémoires du Géant.'
GANDY (Lieutenant). Portsea.
GRAHAM (Mrs.). London.
GREGG (The Rev. G.). Belfast.
GRIMSHAW. London.
HABRO. Worcester.
RICHARD (J. M.). Montjean.
ROSSITER. London.
SAUNDERS (B.). Bristol.
SLEA. Brighton.
ST. ALBIN. London.
STOCKS (Miss). London.

1825.

BECKET (Miss). London.
BLACKBURN (Miss). Preston.
CAPE (Captain). London.
CORNILLOT (M. Pierre). Sevenoaks.
CURRIE (Captain). London.
DAWSON (Miss). Kendal.
DEAN. London.

GREEN (George). London.
GREEN (William). Newcastle-upon-Tyne.
GRISOLLE (Serjeant). Marseilles.
HARVEY (Colonel). Norwich.
JILLARD. Bristol.
JOLLIFFE. Sevenoaks.
PENNY. London.
RADCLIFFE (C.). Blackburn.
RAMSAY. Carlisle.
SELIM-OGAT. Smyrna.

1826.

BARHAM. London.
BROOKE. Boston.
CAVE (W.). London.
CLARK. London.
GREEN (George, jun.). London.
GREEN (Henry). London.
GRISOLLE. Paris.
RICHEY. London.
SAYWELL. Nottingham.
SERJEANT. Stamford.
SIMPSON. Stamford.
SPOONER (Miss). Bolton.
VALE (The Rev. B.). Hanley.
WEDGEWOOD. Newcastle.
WHITTAKER. London.

1827.

ASTLEY (W.). Ashton-under-Lyne.
BACKHOUSE. Ashton-under-Lyne.
BECKET. London.
BROWN. Wakefield.
BROWN (S.). Pontefract.
DAVIES (R.). Hull.
DAVIES (Mrs.). London.
EDWARDS (Miss E. P.). London.
FOX (G.). London.
GEE. Stockport.
GOWARD. Ipswich.
GOWARD (Jun.). Ipswich.
GRAFTON. Macclesfield.
GREEN (Thomas). Mansfield.
GREEN (James). London.
HILL. Hull.
HODGKINS. Doncaster.
JEFFERYS. Birmingham.
KENNEDY. Gainsborough.
LEIGH. Warrington.
MATTHEW (Captain R.N.). Hereford.
OLIVIER (Madame). New Orleans.
PHILLIPS (H. L.). Manchester.
SMITH (W.). Birmingham.
STRAPPS (T. W.). Manchester.
WILLIAMS (W. H.). London.

1828.

BAILEY. Coventry.
BAKER. Southampton.
BEER. Canterbury.
BOUBERRY. Coventry.
CRAMP. Canterbury.
GARDINER (W. H.). Lewis.
GLOSSOP (W.). Sheffield.
GREEN (Mrs. Henry). Rochester.
HEMMING. London.
HOLT (Captain R.). Wigan.
JONES. Hereford.
LYSTER (Colonel). Maidstone.
MALCOLM. Salford.
ORLANDI (Signor). Bologna.
PARKINSON. Bury.
PEARNE (G.). Dover.
PEMBERTON. Preston.
PICKERING. Chichester.
POOLE. Preston.
ROBERTSON (Mrs.). Canterbury.
ROLENS. Rochester.
SCHÜLLER (Madlle.). Berlin.
STEPHENSON (W.). Blackburn.
VOIGT (Herr). Huddersfield.
WILLERTON. Boston.
WOOD. Wakefield.

1829.

BADCOCK (Mrs.). London.
BLITZ. Kidderminster.
BROWN. Dewsbury.
DAINTRY. Cambridge.
DOBNEY. Kidderminster.
GREETHAM (Lieutenant). Portsea.
LAWSON. Keighley.
LLOYD. Birmingham.
MARSHALL. Derby.
MILNES. Cambridge.
RICHARDSON. Derby.
ROBERT (Mdlle. Lambertine). Paris.
SCOTT (G. W.). Cambridge.
SIMPSON. Mansfield.
WESTCOTT (P. T.). London.
WHITCHER. Southampton.

1830.

ACKERS. Cambridge.
BASS. Leith.
BEAUMONT (F. W.). Cambridge.
BRUSSON. Leeds.
CUTTILL (J. B.). Lincoln.
DICKINSON. Stafford.
HOLLOND (Robert, afterwards M.P.). Cambridge. *Went to Nassau in* 1836.
HULKES. Cambridge.
ROGER. Kilmarnock.
THEODORE (Adolphus). Havana.

1831.

BROWNE. Manchester.
CALLANDER (Major). Alloa.
CRAWSHAY. Norwich.
FORSTER (Dr.). Chelmsford.
KENNET (Miss E.). Chelmsford.
KENNET (Miss H.). Chelmsford.
MARSHALL. Norwich.
MILLER. Peterborough.
OYSTON (Miss). Newcastle.
PUCKLE. Lincoln.
REID. Perth.
TURNER (F.). Cambridge.
WOODHOUSE (Dr. J. T.). Cambridge.

1832.

ARMSTRONG. London.
BRAY. Coventry.
FOXCROFT. Lancaster.
GYPSON. London.
HILDYARD. Lancaster.
HOPE. Cambridge.
LEBERRIER (Dr.). Montmartre, Paris.
LEEDS. Cambridge.

LENNOX (Comte de), formerly "chef d'escadron." Montmartre.
LENNOX (Madame). Montmartre.
MERY. London.
PAUMIER. Whitehaven.
SLEA. Penrith.
TAYLOR. Manchester.
TRAVIS. Manchester.

1833.

ARBAN (Francisque), builder. Lyons.
MARSHALL. Worksop.
WESTCOTT (J. H.). London.

1834.

ELLIOT. New Orleans.
VISSOND. Sunderland.

1835.

BUTLER, surgeon. London.
CLATON. New Orleans.
CRAWSHAY (Jun.). Bury St. Edmunds.
DUDLEY-STUART (Lord). London.
GOCHER. Bury St. Edmunds.
HARMAN. Uxbridge.
HOBART. Lynchburg, America.

1836.

BACK. London.
BARCLAY. London.
BRUNSWICK (Duke of). London.
BURNETT. London.
CHEESE (Mrs.). London.
CLANRICARDE (Marquis of). London.
CLARKE. London.
*COCKING. London.
COLLET. London.
COX. London.
DELAFIELD. London.
EVANS (Mrs.). London.
FORTE. Cheltenham.
GREEN (Mrs. Charles). London.
GREEN (Miss Marian). London.
GRENOW (Captain). Paris.
GYE (E.). London.
GYE (Jun.). London.
HARRISON (Miss). London.
HITCH (G.). Gloucester.
HODGES. London.
HOLLOND (Richard). London.
HUGHES (R.). London.
HUGHES (T.). London.
HUGHES (W.). Paris.
KENT (Dr.). London.
MONCK MASON. London. *Went to Nassau.*
OGLE (Captain). London.
PATRICK. London.
PILTÉ. Paris.
PUGH (W.). Gloucester.
ROSCOE (Mrs.). Paris.
RUSH. London.
SPENCER. London.
SPINNEY (Jun.). Gloucester.
STEEL (Thomas). Warwick.
TALBOT (The Hon. W.). London.
TALBOT (Baroness). London.
WARBURTON (E.). Cheltenham.
WHITE (Captain). London.
WISE. Lancaster. America.
WOODROFFE. London.
WOODS J.). Stroud.
WROTTESLEY J. . London.
YARMOUTH Lord . Paris.
YOUNG. London.

1837.

ADAMS W. H.). London.
ADAMS Mrs. W. H. . London.
ADAMS Jun.). London.
ALLEN 'Captain). London.
BARNES (R. B.). London.
BEAZLEY (S.). London.
BISH. London.
BLAKESLEY (Captain). London.
BOXALL. London.
BROUGHAM (Miss Anne). Manchester.
BRUNSDON. Cheltenham.
BUSHE (Johnnie). London.
BUTLER (Lord Walter). London.
CAMPBELL. London.
CARNEGIE (Captain). London.
CARPENTER. Manchester.
CARTTAR (Coroner for West Kent). London.
CHADWICK. Manchester.
CONST. London.
COPLING (Captain).
CREAGH (Lieutenant-Colonel Sir M.). Manchester.
CROMQUELIN (J. L.). London.
CUTHBERT. London.
DAVIDSON. London.
DEAN (Miss). London.
FINCH. London.
GAMBLE. London.
GARRETT. Cheltenham.
GENISTE (Edward). Paris.
GREEN, apothecary. London.
GREEN. Manchester.
GREGORY. Oxford.
GYE (Sen.). London.
HORTON (Captain Wilmot). London.
HUME. London.
LAMBERT. London.
LEICESTER (Captain). London.
LEWIN. London.
JEARRAD. Cheltenham.
JEPHSON. London.
JULLIEN. Paris.
LAING. London.
LORD. Manchester.
MALTITZ (Baron). London.
MANSFIELD. Manchester.
MARR. London.
MONRO (W.). London.
MOSS (J.). Cheltenham.
MUSGRAVE (W. Tunnacliffe). Leeds.
PIRI (Signor). Paris.
POLHILL (Captain). London.
POWER (T.), M.P. London.
REYNOLDS (J.). London.
ROGERS. Leeds.
ROUSE. London.
SEGUIN DE LA SALLE. Paris.
SIMON. London.
SLOAN. Manchester. *The only Englishman except* Tytler *that ever made use of a Montgolfière,*
SNEATH. Mansfield.
SPINNEY. Cheltenham.
TAYLOR. London.
THOMAS. London.
TOLLEMACHE (Captain). London.

TRACEY (H.). London.
VEYSEY. Manchester.
WARWICK. London.
WATSON. London.
WATTS. London.
WEBB. London.
ZICHY (Comte de). Paris.

1838.

TENNYSON. London.

1839.

EUBRIOT, pianoforte-manufacturer. Paris.
HAMPTON (John). London.
LARTET. Agen, France.

1841.

COMASCHI. Lyons.
DAVIDSON. London.
DUDLEY-WARD (Captain). London.

1842.

KERSCH. Bordeaux.
SCHWARTZ, musician. Lyons.

1843.

GUÉRIN (J.). Nantes.
LARTET (Madame). Auch.
VERDUN (Commandant des Cuirassiers). Mans.

1844.

COXWELL (Henry). London. Has made 520 ascents down to the year 1864.
DUPAS (Madlle. Augustine). Paris.
GUILLOT (Rosemond). Cambray.
MARGAT (Madame). Marseilles.
PUGH (J. Reynolds). Stepney.

1845.

BEDFORD (Duke of). London.
ISABELLE (Madlle.). Lille.
MATTHEWS (F., clown at Drury-lane). London.
VANSITTART. Chelsea.

1846.

D'OHOSSON (Baron), Swedish Ambassador. Berlin.
LOPEZ (Don Manuel). London.

1847.

BARLOW (Arthur Pratt). London.
BECKMANN, gymnast. Bordeaux.
BISCHOFFSHEIM. Brussels.
BRIARD (Madlle. Clémence). Bordeaux.
BYRNE. Peckham.
COCKERILL. Aix-la-Chapelle.
GALE. London.
GODARD (Eugène). Lille.
GOULSTON. Peckham.
GRICE (B. C.). Aix-la-Chapelle.
HOOLE. London.
JENNY (V.). Bordeaux.
JOURDAN, undertaker. Paris.
KŒNIG (The celebrated Herr). London.
LEDET. St. Petersburg.
MAIGRET. Bordeaux.
MASSÉ (Madame). Bordeaux.
MEYER. Bordeaux.
ROSSET. Bagdad.
SCHENEDER (Madame A.). Paris.
SMITH (Albert). London.
SOPHIA (Madlle. B.). Paris.
SPURRIER (Captain, R.N.). Bruxelles.
STEFFENS (Adolphe de). Aix-la-Chapelle.
VAN ELEWYCH. Brussels.
VAN HEEKÉ (Dr.). Brussels.
VIDAL (Madlle. Emma). Bordeaux.

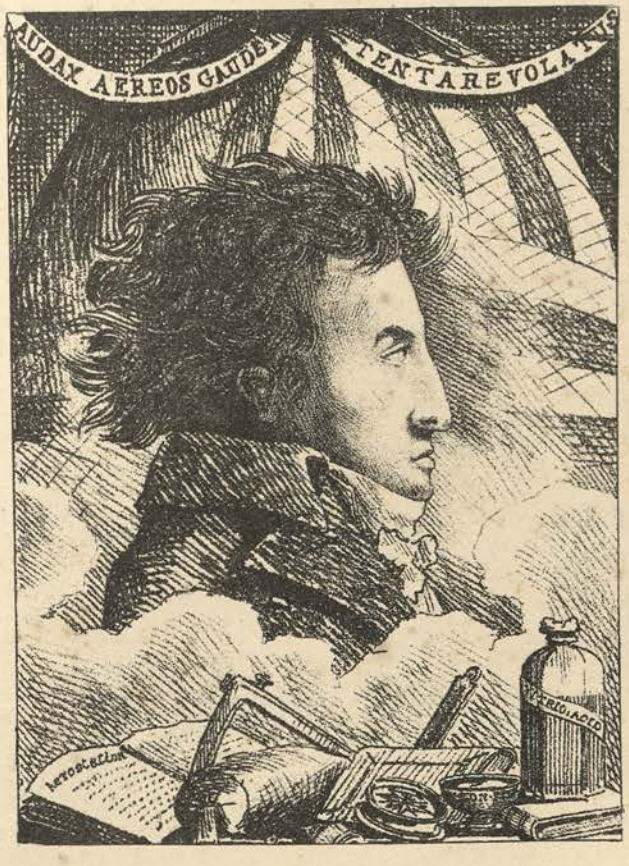
1848.

BEAUVOIR (le Vicomte de). Paris.
BOUQUIÉ (Armand). Paris.
BOUQUIÉ (Ferdinand). Paris.
BRIGNOLA (Madame de). Paris.
CALLOO, hotel-keeper. Brussels.
DELBRASINE, merchant. Brussels.
EVANS (Madlle). Paris.
FENCÈ. Paris.
HARRINGTON. Paris.
JONES (Augustus). Brussels.
LAVALETTE (De). Paris.
MARIA DE LANCY (Madame). Paris.
RAASLOFF (W. de), Captain in the Danish Artillery. Liege.
STOCKS, English engineer. Liege.
TALBOT-BAGOT (George). Paris.
TRASENTER (a Professor at the University of Liege. Liege.
VAN DER DOO, Dutch student. Liege.
WHARINGTON. Brussels.
YATES. Liege.

The names of a party that made an interesting ascent in 1786, are omitted in this list, as the only record we now possess does not give them. It consisted of a Persian physician and two Bostangis of the Seraglio of Constantinople. They ascended from a court of the palace, in the presence of the Sultan, crossed the sea that divides the European from the Asiatic continent, and, after a voyage of four and a half hours, descended at the castle of Brusa, ninety miles from the coast, where the Pacha entertained them hospitably. Upon their return to Constantinople they were received with all the honours which an admiring public could bestow; and the balloon itself, as a memorial of the exploit, was ordered by the Sultan to be suspended in the Mosque of St. Sophia, where it remains to this day (1836). This is the only instance, as yet, in which the passage from one quarter of the globe to another has been effected.

MARQUIS D'ARLANDE.

LOUIS PHILIPPE DUC DE CHARTRES.




M. GARNERIN.

JOHN JEFFRIES, M.D.

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H. Helsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director.*

1864

JEAN PIERRE BLANCHARD.

M. CHARLES.

JOHN HAMPTON.

ROBERT COCKING.

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H. Helsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director*

1864

TIBERIUS CAVALLO, F.R.S.

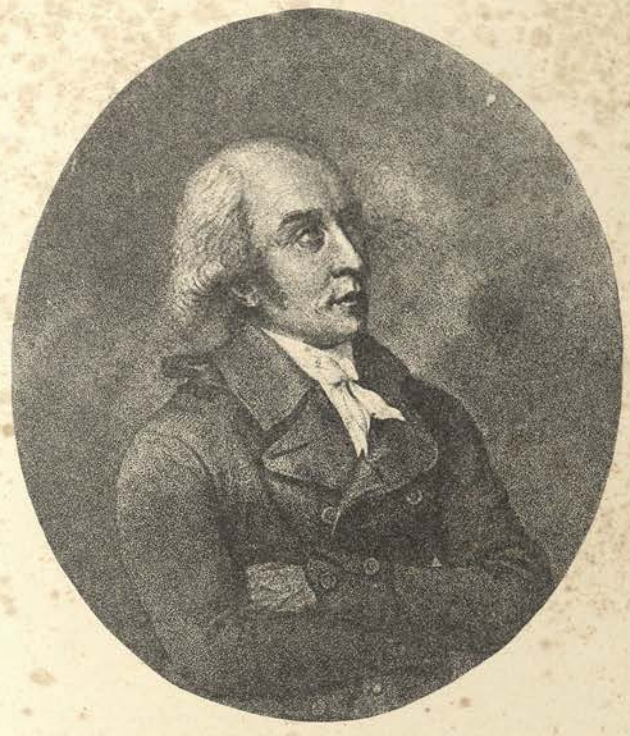
Mrs SAGE.

CHARLES GREEN.

EDWARD SPENCER.

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Heldsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c.Director.*

1864



Mr. SADLER.
THE FIRST ENGLISH AERONAUT.

JAMES GLAISHER, ESQ. F.R.S.

HENRY COXWELL, ESQ.

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Captn. H. Helsham Jones R.E. Col. Sir H. James R.E. F.R.S. &c. Director.*

1864

*Photo-zincographed at the Ordnance Survey Office Southampton under the superintendence of Capt.n H.Holcsham Jones R.E. Col. Sir H.James R.E. F.R.S.&c.Director.*

1864

# BOOKS* HITHERTO PUBLISHED ON AEROSTATION.

The ark which mind has for its refuge wrought
Its floating archive down the floods of time.

SCHILLER *on the Art of Printing.*

"Books are faithful repositories, which may be a while neglected or forgotten; but when they are opened again, will again impart their instruction. Memory once interrupted, is not to be recalled; written learning is a fixed luminary, which, after the cloud that has hidden it has passed away, is again bright in its proper station. Tradition is but a meteor, which, if it once falls, cannot be rekindled."—JOHNSTON.

1627 HERN FLAYDERS, 'De Arte Volandi.' Tubingæ. 12mo.

1648 JOHN WILKINS (Lord Bishop of Chester), 'Dedalus, or Mechanical Motions.' London. 8vo. Also 'Discovery of a New World,' and other books.

1663 WORCESTER, the MARQUIS OF, 'Century of Inventions.' London. 24mo.

1670 FRANCIS LANA (Jesuit), 'Prodromo, o saggio di alcune invenzioni nuove premesso all' arte maestra.' Brescia.

1755 GALIEN (le père d'Avignon), 'L'Art de Naviguer dans les airs, amusement physique et géométrique.'

1775 J. PRIESTLEY, 'Experiments and Observations on different kinds of Air.' London. 3 vols. 8vo. Translated into French by Gibelin. Paris, 1779.

1781 TIBERIUS CAVALLO, 'A Treatise on the Nature and the Properties of Air and other permanently elastic Fluids.' London. 4to.

*1783 FAUJAS DE ST. FOND, 'Description des expériences de la Machine Aerostatique. Paris.' 8vo.

1783 LIEUT.-COL. JOLY DE SAINT-VALIER, 'Lettre à Madame la Princesse de . . . à Petersbourg—sur les Balons.' Ostend. 8vo.

*1783 MEUSNIER (attained the rank of General), Lieut en premier au Corps Royal du Génie et de l'Academie Royal des Sciences. 'Mémoire sur l'équilibre des Machines aérostatique, sur les différens moyens de les faire monter et descendre, et spécialement sur celui d'exécuter ces manœuvres, sans jeter de lest, et sans perdre d'air inflammable, en ménageant dans le ballon une capacité particulière, destinée à renfermer de l'air atmosphérique.' Présenté à l'Académie le 3 Décembre.

1783 M. PINGERON, 'L'Art de faire soi même les Ballons Aerostatique.' Amsterdam.

1783* M. Le COMTE DE BARRUEL, 'Lettre à Monsieur le Président de . . . . .' Londres.

1784 STEPHEN CALVI, 'A method of directing Balloons in which inflammable air is employed, accompanied with a description of a new Barometer.' Milan. 8vo.

1784 BRUNSWICK (FREDERICK AUGUSTUS, DUKE OF), 'The Thoughts of a Cosmopolite on Air Balloons,' in German. Hamburg. 8vo.

1784 PILON (FREDERICK), 'Aerostation; or, the Templar's Stratagem. A Farce.' London. 8vo.

1784 GALVEZ (COMTE DE), 'On the means of directing Aerostatic Machines.' Philos. Trans. Abridg., xv. 635.

1784 BERTHOLON DE (ST. LAZARE), 'Des avantages que la physique et les Arts peuvent retires des Aërostats.' 8vo.

1784 MARTYN (THOMAS), 'Hints of important uses to be derived from Aërostatic Globes.' London. 4to.

*1784 LUNARDI (VINCENT), Secretary to the Neapolitan Ambassador, 'Account of the first Aerial Voyage in England, in a Series of Letters to his Guardian.' London. 8vo.

1784 VIVENAIR (MONSIEUR), 'Account of a Journey lately performed through the air in an Aerostatic Globe.' London. 8vo.

1784 —— 'The Air Balloon; or, a Treatise on the Aerostatic Globe.' London. Kearsley, 8vo.

*1784 GERARD (L. J.) 'Essai sur l'Art de Vol Aérien.' Paris.

*1784 M. DE MONTGOLFIER, 'Sur l'Aérostate,' prononcé dans une Séance de l'Académie des Sciences, Belles-Lettres et Arts de la Ville de Lyons en Novembre, 1783. Paris.

*1784 A. G. ROZIER, 'Dissertation sur les Aerostates.' Geneva.

*1784 BOURGEOIS (DAVID), 'Recherches sur l'Art de voler, depuis la plus haute Antiquité jusqu'à ce jour.' Paris.

1784 COUNT DE MILLY, 'A pamphlet on inflammable Air.' It was reviewed as follows in England, and is, I believe, one of the earliest notices of one of the most important uses to which coal can be applied:—

> "The paper on the production of inflammable air that seems to interest this country most, is that which describes the method of extracting it from pit-coal. The discovery, if it really be a discovery, which we have some reason to doubt, was made by Mr. Thysbaert and two other professors of the University of Louvain; and the process is thus, rather imperfectly, described:—'A common forge, and three common gun-barrels, about one inch in bore, were the whole of the apparatus; the breech ends of two of the barrels were constantly kept in the fire, whilst the third, being cooled and emptied, was loaded about six inches high with powdered pit-coal, and the rest filled with sand. A tin tube conveyed the air under a funnel, placed beneath a barrel filled with water, which stood upon a tub likewise filled with water, which the air extracted from the coal replaced, after having traversed it.' Fifteen ounces of powdered pit-coal yielded in about three-quarters of an hour 100 quarts (*pots*) of air, of so pure a quality, that on trial it was found to raise a balloon as rapidly and as high as if it had been filled with the usual inflammable air. The operation is soon to be repeated on a larger scale, and large iron retorts are making for the purpose.
>
> "M. Morveau, of Dijon, has produced inflammable air from potatoes by mere distillation. He hopes soon to improve his method; and we shall probably hear more of it in the next volume of this collection."

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* The books marked * are at the service of the public in the library of the Patent Office, Southampton Buildings, E.C.

*1785 BALDWIN (THOMAS), 'Aeropedia; containing the Narrative of a Balloon Excursion from Chester.' Chester. 8vo.
1785 MARY ALCOCK, 'The Air Balloon; or, Flying Mortal:' a Poem. 4to. Maclew, London.
1785 —— 'The Balloon: a Satire.' 4to. Flexney, London.
1785 —— 'The Aerostatic Spy; or, excursion with an Air Balloon.' London: Symonds. 2 vols. 12mo.
1785 LUNARDI (VINCENT), 'Account of his second Aerial Voyage from Liverpool,' 9th August, 1785. London. 8vo.
*1785 CAVALLO (TIBERIUS), 'History and Practice of Aerostation.' London. 8vo.
*1785 SOUTHERN (JOHN), 'Treatise on Aerostatic Machines.' Birmingham. 8vo.
1785 Jeffries (Dr.) 'A Narrative of two Aerial Voyages, with Meteorological Observations and Remarks. Read before the Royal Society in January, 1786.' 4to.
1785 PINGERON, 'L'Art de faire soi-même les Ballons.' Amsterdam.
1786 BALDWIN (THOMAS), 'Hints on the improvement of Balloons,' etc. The whole serving as an introduction to Aerial Navigation. Chester. 8vo.
1786 URQUHART (GEORGE), 'Institutes of Hydrostatics, to which is added a Philosophical Essay on Air Balloons.' London. 8vo.
1786 LUNARDI (VINCENT), 'The Account of five Aerial Voyages in Scotland.' London. 1786.
1788 HENZION, 'Sopra le Machinè Aerostatique.' Florence.
1798 —— 'Symposia; or, Table Talk in the month of September, 1734 (sic), being a rhapsodical hodgepodge, containing among other things Balloon intelligence for the years, 1785, 1786, 1787.' London, Bew. 12mo.
1803 LIEUT.-COLONEL MONEY (attained the rank of General), 'Treatise on the use of Balloons and Field Observations in Military Operations.' London. 8vo.
1803 LOMET (A. F.), 'On the Employment of Aerostatic Machines in the Military Science, and for the contraction of Geographical Plans.' Nicholson's Journal, vol. vi. 194.
1805 LUSSAC (GAY), 'Account of an Aerostatic Voyage made by him.' Nicholson's Journal, vol. x. 298.
*1810 WALKER (THOMAS), portrait painter, 'The Art of Flying.' Hull.
*1810 J. MOSNERON, 'Le Ballon Aérien.' Paris.
1814 BEAUFOY (HENRY), 'Journal kept during an Aerial Voyage with Mr. James Sadler, from Hackney, Middlesex.' Ann. Philos. p. 282.
1816 EDGEWORTH (RICHARD LOVELL), 'On Aerostation.' Phil. Mag., vol. xlvii. 185.
1816 MARMADUKE, MAC-CAUSTIC, 'A Trip from the Moon.' London.
1819 DONINI (GIUSEPPE), 'Saggio Aereonautico.' Firenze. 8vo.
1823 DONINI (GIUSEPPE), 'Circolare Areonautico (sic) di Cettà de Castello a tutti i dotti, e ricchi Nazionali, estranieri.'
1825 DEPUIS DELCOURT, 'Mémoire sur l'Aérostation et la Direction Aérostatique.' Paris.
1825 DEPUIS DELCOURTT, 'Comte Rendu de l'expérience de la Flotille Aérostatique partie de Mont-Jean le 7 Novembre, 1824, montée par MM. Depuis Delcourt et M. Richard.' Paris.
*1827 GEORGE POCOCK, 'The use of Kites and Buoyant Sails.' Bristol.
1830 SIR JOHN LESLIE, 'The Article on Aerostation' in the Encyclopedia Britannica.
*183 DEPUIS DELCOURT, 'Essai sur la Navigation dans l'Air.' Note présenté à l'Academie Royale des Sciences de Paris. Paris.
1832 T. FORSTER, M.B, F.L.S, F.R.A.S, 'Annals of some remarkable Aerial and Alpine Voyages, including those of the author.' London. 8vo.
*1838 MONCK MASON, 'Aeronautica.' London.
1845 COXWELL (HENRY) 'Aerostatic Magazine.'
1845 J. MACSWEENY, 'Aerial Navigation.' 12mo.
1847 MAREY-MONGE (Edmond). 'Études sur l'Aérostation.' Paris. 8vo.
1849 DEPUIS DELCOURT, 'Manuel complet d'Aérostation, extrait en grande partie du "Traité historique et pratique de la Navigation dans l'Air," ouvrage encore incomplet, que je publierai plus tard.'
1850 JOHN WISE, 'A System of Aeronautics, comprehending its Earliest Investigations.' Philadelphia.
1850 LOUIS FIGUIER, 'Les Aérostats.' Revue des Deux Mondes.
1851 JULIEN TURGAN, 'Histoires de la Locomotion Aérienne depuis son origine jusqu'à nos jours.'
*1851 John LUNTLY, 'Air Navigation' (rotary). London.
1854 HENRY COXWELL, 'Balloons for Warfare.' A pamphlet.
1855 W. BAYLEY, 'Aerial Navigation' (perspective). 8vo.
*1855 GEORGE JAMES NORMAN: 'AERONAUTICA ILLUSTRATICA, A COMPLETE CABINET OF AERIAL ASCENTS AND DESCENTS, FROM THE EARLIEST PERIODS TO THE PRESENT TIME.' 10 large Folio vols. London.†
1861 H. GUILBAULT, 'Direction des Aérostats, Système Nouveau.'
1861 LOUIS FIGUIER, 'Les Grandes Inventions' (20th Chap.). Paris.
1863 DR. PIERRE MOREAUD (Membre de la Société Aerostatique et Metéorologique de France), 'Chemins Aériens. Application de la Vapeur à la direction des Aerostat Captifs.'
1863 Article 'Revue des Deux Mondes.'
1863 DE LALANDELLE, 'Aviation, ou Navigation Aérienne.' Paris. 8vo.
1863 DELAVILLE-DEDREUX, 'La Navigation Aérienne en Chine.' Paris.

† The cost of making this collection exceeded 300*l*. It was twice sold by auction, and bought the second time for the library of the Patent Office for 26*l*. The collector is a young man in somewhat distressed circumstances. To his industry the author owes the greater part of his own collection, as they were the duplicates that necessarily accumulate in so extensive a collection.

1864 CHARVIN, 'La Navigation Aérienne par les Aérostats.' Paris.
1864 NADAR, 'Mémoires du Géant, preface par M. Babinet.' Paris.
1864 L. DAVID (Membre de la Société Aérostatique et Météorologique de France), 'Solution du Problème de la Navigation dans l'Air par la direction des Aérostats.'
1865 ARTHUR MANGIN, 'L'Air et Le Monde Aérien,' Chap. vii. Tours.

## MEDALS.

AMBITION sigh'd: she found it vain to trust
The faithless column and the crumbling bust.
Huge moles, whose shadow stretch'd from shore to shore
Their ruins perish'd, and their place no more;
Convinced, she now contracts the vast design,—
And all her triumphs sink into a coin.
A narrow orb each crowded conquest keeps;
Beneath her palm here sad Judéa weeps;
Now scantier limits the proud arch confine,
And scarce are seen the prostrate Nile or Rhine;
A small Euphrates through the piece is roll'd
And little eagles wave their wings in gold.

POPE.

1783 JOSEPH and STEPHEN MONTGOLFIER. Bronze.
1783 Pour avoir rendu l'air navigable. Bronze.
1783 Experiment of the Champs de Mars, August 17. Bronze.
1784 Ascent from Lyons, January 19. Bronze.
1784 PAOLO ANDREANI, first ascent in Italy, 3rd March. Bronze.
1784 VINCENT LUNARDI, first ascent in England, 15th Sept. "Et se protinies theoria tollit in astra." Bronze.
1785 BLANCHARD'S fifteenth ascent. White metal.
1785 BLANCHARD'S twenty-eighth ascent. White metal.
1786 BLANCHARD'S ascent. White metal.
1803 GARNERIN'S ascent. Silver.
1823 ISAAC EARLYOMAN SPARROW, Oxford. Copper.
1836 London to Weilburg in eighteen hours. Silver.

## ART.

WHEN from the sacred garden driven,
Man fled before his Maker's wrath,
An Angel left her place in heaven,
And cross'd the wanderer's sunless path.
'Twas Art! sweet Art! New radiance broke,
Where her light foot flew o'er the ground;
And thus with seraph voice she spoke,
"The curse a blessing shall be found."

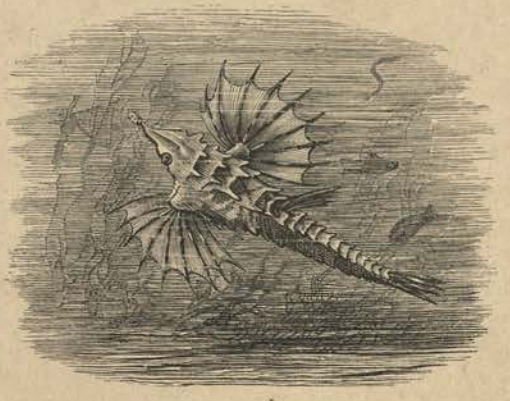
She led him through the trackless wild,
Where noontide sunbeam never blazed:
The thistle shrunk—the harvest smiled,
And Nature gladdened as she gazed.
Earth's thousand tribes of living things,
At Art's command to him are given,
The village grows, the city springs,
And point their spires of faith to heaven

He rends the oak—and bids it ride,
To guard the shores its beauty graced;
He smites the rock—upheaved in pride,
See towers of strength, and domes of taste.
Earth's teeming caves their wealth reveal,
Fire bears his banner on the wave,
He bids the mortal poison heal,
And the destroying knife to save.

He plucks the pearls that stud the deep,
Admiring Beauty's lap to fill;
He breaks the stubborn marble's sleep,
Rocks disappear before his skill:
With thoughts that swell his glowing soul,
He bids the ore illume the page,
And proudly scorning time's control,
Commerces with an unborn age.

In fields of air he writes his name,
And treads the chambers of the sky;
He reads the stars, and grasps the flame
That quivers in the realms on high.
In war renowned, in peace sublime,
He moves in greatness and in grace:
His power, subduing space and time,
Links realm to realm, and race to race.

SPRAGUE.



PEGASUS VOLANS.

## THE BALLOON.

The *airy ship* at anchor rides,
Proudly she heaves her painted sides,
  Impatient of delay;
And now her silken form expands,
She springs aloft, she bursts her bands,
  She floats upon her way.

How swift! for now I see her sail
High mounted on the viewless gale,
  And speeding up the sky;
And now a speck in ether lost,
A moment seen, a moment lost,
  She cheats my dazzled eye.

Bright wonder! thee no flapping wing,
No labouring oar, no bounding spring,
  Urged on thy fleet career:
By native buoyancy impelled,
Thy easy flight was smoothly held,
  Along the silent sphere.

No curling mist at closing light,
No meteor on the breast of night,
  No cloud at breezy dawn,
No leaf adown the summer tide
More effortless is seen to glide,
  Or shadow o'er the lawn.

Yet thee, e'en thee, the destined hour
Shall summon from thy airy tower
  Rapid in prone descent;
Methinks I see thee earthward borne
With flaccid sides that droop forlorn
  The breath ethereal spent.

Thus daring Fancy's pen sublime,
Thus Love's bright wings are clipped by Time;
  Thus Hope, her soul elate,
Exhales amid this grosser air;
Thus lightest hearts are bowed by care,
  And genius yields to Fate.

*Annual Register*, 1811.

## MR. COXWELL'S ADDENDA.

This Addenda of amusing anecdotes was kindly sent me by Mr. Coxwell, who calls it—

### AERONAUTIC SKETCHES FROM AN UNPUBLISHED DIARY.

In the beginning of May, 1848, I received an invitation to make some ascents at Brussels. The preliminary arrangements for the supply of gas had been entrusted to an agent, who was altogether destitute of that tact and forethought which ensure success to many of our English managers. Contrary to a previous understanding, I was obliged to fill my balloon at the gasworks, and to attempt to remove it in an inflated state towards the Prado Gardens. This is at all times an objectionable process, especially in windy weather. It was the only alternative as matters stood, and consequently we set out before daylight to inflate the balloon, with a view of getting it into the Prado before the citizens were astir. Grey-eyed morn broke in with serenity and promise; but as weather, like friendship and many other things, is not to be depended upon, we soon beat to quarters, as nautical men say, and commenced action. The balloon began to display its proportions most satisfactorily, and the lookers-on threw themselves into various postures indicative of approbation. "*Ah! Monsieur Coxvel*," said one of the party, stroking down his beard, "*you vil hav vun wery fine day—no vind, no nothing. Your transport vil not be difficile.*" Hereupon I glanced around the horizon, but returned the weather-wise gentleman no reply; he then observed my countenance so narrowly as to perceive a slight expression of discontent. "*Vat you mean?*" said he. "*Vy you frown?*" The fact was, a small, solitary, darklooking cloud had made its appearance to westward, and although at a considerable distance, was wending its way up with rapidity; the configuration and general aspect of this little intruder on the blue sky foreboded wind, as it swept along swiftly, anon changing form and hue, as if agitated by sudden atmospheric impulse.

"Gentlemen," said I, "there is a strong wind prevailing at no great distance from the earth; and if it does not extend to the surface before the balloon reaches the Gardens, we may consider ourselves fortunate."

The bystanders protested against the probability of this apprehension being verified, and discussed the matter with flourishing action of the hands and much useless verbiage. They would fain, too, induce me to enter upon argument; but I rejected, I hope politely, all invitation of this sort, and informed my right-hand man that the order of the morning must be smart work, not words. We immediately directed our attention, while the foreigners were talking, to secure the netting to the hoop, so as to get a fair and equal bearing from a strong centre, and had just completed this necessary precaution, when the long green grass and verdant foliage around us bent to leeward with a low, murmuring sound; and in less than ten minutes after Nature had given her first gentle but unmistakable symptoms of an approaching gale, one fitful gust broke upon us, creating, as it acted upon the half-filled balloon, a boisterous, bellowing sort of music, which only loud Boreas is accustomed to indulge in.

Around the hoop and in the car were placed about forty half-hundred weights, there stationed in order to steady the restless machine, which was soon performing most graceful sweeps over our heads, to the no small

amusement of a host of lookers-on, who added to our numbers in proportion as activity increased in the city. The manager of the gardens was for a precipitate retreat to the Prado, but as that was altogether impracticable until the wind dropped, it was necessary to exercise coolness and generalship in the predicament which we were placed in. "*Vat you vil do?*" cried the spokesman of the Belgian party, the same who promised "*no vind, no nothing.*" "Why, sir," I replied, "the fact is I have to contend with a most formidable opponent, and I think I can't do better than imitate the plan pursued by Wellington at Waterloo; that is, to receive the attack, and act purely on the defensive. "*Then, ser, you vil not go to the gardens?*" "No," I replied; "I have enough to do to stand my ground." Our friend, in common with his companions, was quite ignorant of the power of a large balloon when subjected to a strong wind. He proposed my advancing in the very teeth of it; so by way of demonstrating the difficulty with greater effect than mere words could produce, I gave orders for an experimental move forwards.

Our forces, so to speak, were thus divided—twenty burly Belgian mechanics at the car; six to each guy-rope; about forty to two strong ropes fastened to the hoop, with a view of pulling the balloon forwards; myself in the car giving directions; a friend, who was tolerably well up in French, acting as interpreter; manager, and the public garden subordinates, small fry, &c., were at their respective posts, shouting vociferously, and thereby confounding the second in command. In this half-formidable, half-comic way, we were grouped, when I gave the word "*Forward.*" Away we dashed for the first few steps right handsomely, when suddenly flap, round, up, down, went the balloon, rolling her huge head to the very grass beneath, upsetting more than half of the party, and forcing the rest into grotesque or awkward positions, as the case might be. One fellow, grasping a rope more tenaciously than prudent, was thrown up as if tossed by a bull, whilst all were driven twice as far back as we had advanced; thus proving the truth of my statement, that we had quite enough to do to stand our ground, without getting further into the scrape.

Having moved sideways towards a somewhat sheltered spot, a fresh difficulty presented itself in the shape of a file of soldiers, who drew up in close proximity to the balloon, an officer advanced and summoned me to his presence. There was something mighty ominous in the under-toned conversation betwixt this officer and myself. I could perceive that all parties lent their ears and preserved the utmost silence. "*What is it?*" cried several eager bystanders. For my own part I preserved a cautious silence. My agent, who knew much of men and manners, took another view of the case, and even had the temerity to increase the highly-wrought curiosity, by rushing to the car and crying out only these words, "*Watch us.*" I could not but think that the request, or rather its translation in Flemish and French, was addressed with but ill-grace to persons who were observing as closely as possible everything that passed. My agent, who was now in the car, took his own view of the case, and it was strange that "*Watch us,*" in its laconic address to the perceptive faculties, produced more effect than a direct answer to curiosity. Whilst "watch us" was working its magical influence, we had removed all control over the balloon, save one rope that was attached to the liberating-iron. Quite unexpectedly, I pulled the trigger, and up we bounded, to the astonishment of everybody present. A cry was now raised that the rope had broken, but the officer, who knew to the contrary, then came forward and explained, as we afterwards learned, the suddenness of our flight. "I was commissioned," he said, "to inform the aeronaut that the assemblage of persons caused by this balloon is disapproved of by the authorities, during the present unsettled state of political affairs. I requested, therefore, that as the balloon could not be removed to the Gardens, the gas should be let out, and the balloon packed up." This Mr. Coxwell declined to do, stating that an English aeronaut could not do that; so he resolved, notwithstanding the storm, to remove the balloon his own way; and I think his tact may be complimented. After this declaration, three lusty cheers were sent up by way of approval; but they reached us faintly as we glided away with great velocity, and in less than twenty minutes got a long way below Antwerp, where we made a rough landing on a large common, and returned as quickly as possible to Brussels.

As the press was pleased to eulogise this trip as something daring and extraordinary, I was immediately solicited to make another, with the inviting proviso that the pipes should be laid into the Gardens, so as to obviate a similar unpleasantness. The inflation this time proceeded under diametrically opposite circumstances to those which accompanied the first, and the appearance of the whole affair struck me as affording an emblem of life in its varied phases—one period cloudy and distracting, at another mild, sunny, and all that the heart desires. The balloon now stood proudly erect, and seemed to bask in the sunshine, occasionally evincing a tendency to rise in the upper air, as if to escape the heat below by seeking the refreshing coolness of the skies. Two gentlemen presented themselves as candidates for aeronautic fame, and I closed with them both. At the appointed hour the Garden artillery gave forth a miniature peal, and we set out for a calm, delightful journey, hovering over Brussels until we were 4000 feet high, when a gentle current wafted us towards the plains of Waterloo. It was my first glimpse of the battle-field, and distance had reduced its bounds to such insignificant limits, that I felt hardly reconciled to the fact that on that little cluster of fields, which looked so green and rural, the fate of Europe had been decided in so great and sanguinary a contest.

I soon found that my companions contrasted rather broadly in taste and character. Mr. ——, or No. 1, was poetical and observant of the beauties of nature, whilst No. 2 displayed a mechanical and mathematical turn of mind, watching every action of mine with a desire to understand the evolutions going forward. "Now," said he, "you have told me to mark down a certain number of figures; what do they all mean?" "The first row," I replied, "indicates our altitude by barometrical measurement; the second, the temperature of the air, as shown by the thermometer; this the degrees of dryness or moisture as indicated by——" "The Lion, by George!" cried No. 1, who didn't love figures, but had espied the mound whereupon stands the lion, as visitors to Waterloo well know. The discovery of a lion, and such a lion, in such a place, demanded our immediate respects. No. 2 declared he could only detect the mound looking like a molehill, and the reported king of the forest was nothing more, he said, than a mare's nest. "Should we not descend upon a spot so memorable?" inquired the enthusiast, No. 1. "The gentleman wishes to fall at Waterloo," said the matter-of-fact passenger. "For my part, I think he's too late for the fair." This sarcasm, softened down a bit by an unceremonious interruption on my part, we wended our way down, and finally alighted no great distance from the fields of Waterloo.

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## THE BALLOON RACE, 1860.

*To the Editor of 'The Times.'*

SIR, Church-road, Tottenham.

As it was announced in your impression of Saturday that two balloons would ascend from the Crystal Palace on Monday, the 22nd, I beg to supply you with the particulars of the race, in the event of an authentic account being considered sufficiently interesting for publication.

At 2 P.M., the "Mars" being then about two-thirds inflated, a series of partial ascents took place from the Palace grounds. The breeze was high for that experiment, but a large number of ladies and gentlemen were gratified; and during these short trips, the "Queen," my second balloon, was being filled in the archery-ground.

A friend of mine and amateur aeronaut, Mr. Allan, had undertaken to pilot the "Queen;" and one, among several applicants, I selected to accompany me in the car of the "Mars."

Neither balloon was much more than half-full at starting, but the "God of War" being the larger of the two, enabled me to take one passenger, when the conditions of the race, viz., an equal amount of ballast and lifting power, became fair and equal.

At 4.40 the start took place, when the "Queen," like a restiff racer, made a "gibe" for *terra firma*, by way of testing, it would seem, the mettle of the rider. Once away, however, her aerial majesty mounted high and soared above "Mars," as much as to say, "You are the representative of strife; I rise above such deeds, and will have no companionship with you."

The cars of the respective balloons were red and blue, but at 5 o'clock red, the highest, appeared to have bolted out of the course, as we lost the run of it altogether. This circumstance aroused the true jockey spirit with us in the blue car, and out streamed fifteen pounds of sand, when we sighted red, and broke the silence of mid-air with a stentorian nautical shout, "'Queen' ahoy! where are you going to?" "Come up and see," was the defiant reply.

The challenge was not long uttered when we found ourselves at equal elevations, just 4200 feet from the earth by accurate measurement. As we passed the "Queen" we right loyally doffed our caps and gave a cheer. "Mars" was now in the ascendant, and quickened his pace with astonishing rapidity.

Whether the "Queen" was calmly awaiting the natural course of events, or resting on her laurels, we could not then and there decide.

Away the "Mars" bore—up, up, till the chill air and barometer told of over 9000 feet elevation, while a survey of the other balloon—now a top, apparently, spinning over Greenwich—convinced us that the odds were in our favour, and that it was 4 to 1 the mastery would be with "Mars."

The appearance of the earth, or, as it appeared to us, the gigantic map with a golden ball passing across it, was something *sui generis*, and extremely interesting. The varying position of the balloons caused us occasionally to be at fault as to the direct line of progression. The "Queen" seemed to be performing some eccentric manœuvres, which kept us in full speculation as to the real course she was pursuing. The Thames was crossed just over Greenwich, when the lower balloon made for the North Woolwich Gardens, as if by attraction to a spot where she was once familiar. But there was no rest for her this side Barking Creek; onward she steered, and struggled for in length what she had lost in height.

The shades of evening having now set in, I decided upon lowering, and finishing the race at equal altitudes.

The eye of my fellow-traveller, Mr. E. Smith, was, in obedience to orders, busy with the movements of our opponent. At 5.45 he reported the "Queen" had halted on a dark patch of about two inches square, which I recognised as a large fallow-field. We now decided upon following suit. A thick autumnal fog was rising over the Essex landscape in curious and fantastic forms. The moon had risen, and produced by reflection on various pieces of water a series of moonlight scenes such as artists and the admirers of nature love to catch a glimpse of views that, had I been master of the brush, would have busied me in depicting on canvas instead of describing from recollection.

That beautiful view beguiled us while we journeyed on to Doddinghurst, in Essex, where we alighted in a meadow at 6.5, being about twenty-five miles from the Crystal Palace. The "Queen" descended four miles south-east of Barking, and the descent was cleverly managed by the amateur, who declared, when we met in town, that if he had had more gas and ballast he would have led me a nocturnal trip into Suffolk.

I remain, Sir, yours obediently,

HENRY COXWELL.

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A NIGHT AMONG THE CLOUDS.

In a communication received by Mr. Webster, the Secretary to the Derby Arboretum, the celebrated aeronaut, Mr. H. Coxwell, writes as follows:—"After ascending from the Crystal Palace on Monday, I had to go off to Dudley Castle, where I made another trip on Wednesday. I had a second interesting voyage the same night by moonlight. After landing my passengers at Tamworth, in Warwickshire, I halted three hours, partook of the hospitality of a farmer, and started again at eleven o'clock; the moon being at the full, and a fine sky overhead. My object was to work the balloon up to London, the wind being fair, and to enjoy a night among the clouds, lighted up and beautified as they were that truly serene night. I was three hours aloft, but at 2 A.M. the wind chopped round to south-west, and as it was not my intention to go back I descended, and found myself at Hellidon, in Northamptonshire, not far from Daventry."

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Seventeen years since, I made three ascents from Chelmsford, when each time the car was occupied by a gentleman with top-boots and agricultural respectability. A wag declared that there was a wholesale flight of farmers from the market-town, and, odd enough to relate, we descended close to the residence of one of the passengers, and, at the request of this landed proprietor, the gas was retained all night, so as to have another trip the following morning. Before we finally ascended again, the gentleman's family visited the "Sylph," and each in turn had a partial ascent. Last of all came the eldest daughter, a charming young lady of about twenty. Her parent and his men held the rope, and I afforded her an aeronautic survey of their grounds. I shall never forget the delight and enthusiasm displayed at the panoramic view. "This is exquisite and beautiful in the extreme!" exclaimed the young lady. "Oh, pray cut the rope, and let us ascend as high as possible." As I was engaged to papa, I could not honourably elope with his daughter, but this incident redounds to the courage of the gentler sex, and serves to show how different are the feelings of aerial voyagers from what most persons imagine.

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I once made a night ascent from Vauxhall Gardens, in company with two gentlemen, and after discharging fireworks we came down near Croydon. It was a still night, and we pulled up without a grapnel or the least possible shock. The outline of a small farmhouse caught my attention, and was nearly underneath us. We could observe, also, the flickering of a candle, as well as hear voices, which led to the conjecture that the premises were being secured for the night. "I think," said I, "we can have a bit of fun here; the parties evidently don't see us, and it's ten to one they don't look up." It was unusually dark, and I sung out, "Yu-uph, give us a hand here, will ye?" at the same time I allowed the "Sylph" to drop within about twenty feet of the ground. A gouty, elderly man came hobbling along towards the hedge, candle in hand, and said, "Eh, wat want? Who's there?" "A friend," said I; "and I want to enter your dwelling." "Eh, lad, that wun't do at any price. Why, drat the man, where hare ye? and what do ye want?" I then broke out in the following strain:—

Of these I am who thy protection claim,
A watchful sprite, and Aerial is my name.

Then one of the gentlemen commenced singing, "We fly by night," when down dropped his candle and quickly fled the countryman, exclaiming, "Eh, missus, but he's come at last, and no mistake!" "Who's come at last?" cried

the better half, bounding out with another light. "Look ye, Sally," said he, pointing to the dim, dark outline of the balloon, "that's the old gem'man himself, or else I'm a Dutchman." To have created further fright would have been carrying a joke too far; we therefore informed the old pair of the nature of the apparition, but astonishment and incredulity were so strong that one of the party had enough to do to convince them we were not demons; and it was not until the balloon was seen, felt, and smelt, and we ourselves handled, that the good people believed our story of a nocturnal journey through the atmosphere.

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In one of my trips from the Pavilion Gardens, North Woolwich, two seats were occupied by a couple of gentlemen, one of whom rejoiced in the Christian name of Tom, and looked as if he lived on his means; the other was evidently enjoying a few hours scientific recreation at the request of Tom, who was standing treat, I rather guess. Tom was the elder of the two, and they were both very nice agreeable companions. The younger gentleman wore, I perceived, a side pocket in his coat, and I was rude enough to notice some papers therein, which were tied round with red tape. Our descent took place not far from Romford; and one person in particular, having a semi-military appearance, made himself officious, and denounced such visits as "demded impertinent." He was even recommending the seizure of the balloon, and the imprisonment of the intruders, as he styled us, when our friend with the side pocket came to me and said, "You shall see how I'll take the cropple out of that fellow's crown; he's the very man I want, and little did I expect that your balloon would place him at my disposal." "Sir," said Tom's friend, withdrawing something from his pocket, "allow me, as one of the party you would like to send to prison, to return my thanks by presenting you with a writ. I believe that paper concerns you, and I hereby hand it in before witnesses." The chapfallen bully was fairly caught, and opportune indeed was his degradation.

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Now for a "night in a field, a bed in the car, and a breakfast at a farmhouse." Many years since, I made a series of ascents from the New Globe Pleasure-grounds, Mile End Road. The day announced for one of these weekly excursions was inauspicious, and the undertaking was almost postponed. At midday the clouds lost their leaden aspect, the rain ceased, and the sun broke forth; consequently I volunteered, although late to begin, to inflate the balloon. The wind being boisterous, I was carried away beyond the customary length of evening flight, and I wandered away down—goodness knows where, anticipating that the breeze would go down with the sun, and favour me with an easy landing. This expectation was realised, but it was quite dark when I alighted, and the place appeared uncommonly outlandish. Being alone I required assistance, for which I sung out pretty lustily; but a full half-hour elapsed and no one came. I tried to let the gas off, but was terribly bothered for want of a few sturdy helpmates to press the netting. After I had mastered the wayward "Sylph," I resolved to set out on an exploring expedition, and to obtain aid and refreshment. I found a gate close to a cross-country road, so placing a lump of chalk which presented itself to view, opposite the gate as a landmark, I struck out, and, after walking for a quarter of an hour, came to a farmhouse. "All right now," thought I; "here, at least, I can obtain assistance;" so away I bounded over the gate, when out sprang a tremendous dog, affording me only a hair's-breadth escape for my rashness; for I just cleared the gate, I can't remember by what particular means, when the faithful creature snapped with a furious set of grinders at my heels, so that I decamped, musing over the old adage, "Discretion is the better part of valour." "Now then," said I, "let's try the other way." I returned to the gate where lay the piece of chalk, and passed by, not exactly in the best of temper, and walked again fully two miles before I came to a village.

Hearing footsteps, I hastened on, and met a workman, returning as I guessed from the alehouse. "Hallo, my man," I cried, "you're the very person I want; take me to the first public-house, and I'll give you a shilling. The man stopped, looked at me, shook his head; and said, "No; I think you're best alone." "Alone," said I; "I've had enough of that, my lad; why I've just come down in a balloon." "Dare say you have," said the fellow, unbelievingly. "Well, what county's this?" "*Ah! you'd better larn that from the county gaol, where I dare say you're pretty well known.*" At this juncture I hardly knew which to do, whether to turn up my sleeves and have a round turn with the fellow, or to break forth in unrestrained laughter. Hearing the measured step of a policeman, I turned from the civilian to the official, and now, thought I, I'm as good as housed. "Good evening, officer; being a stranger here, I am on the look-out for a public-house." "Yes," said the constable, drawing himself up, "that I can guess." "Just be good enough to point one out," said I, "and take a glass with me, for I have come from London in a balloon, and want some refreshment and help." "*Ah!*" said he, turning upon his heel and looking round, "*take my advice and move on.*" "Well," said I, "you surely must be a gang of thieves in this place, for an honest man won't pass muster at all. However, I'll try the public-house." After knocking, a window was thrown open, and somebody asked, "Who's there? and wat'e wunt?" "I am a stranger

from London, having descended a short time since with my balloon." I could proceed no further with my tale, as the window was slammed down, and the man, indulging in a hoarse laugh, said, "*That's as gud-a-un as I've herd for some time, that be.*"

It may be thought that I am over-narrating this adventure, but I am really abiding even within the facts—the reasons for such strange and brutish conduct will presently transpire. "Now for one more trial," thought I, "and I will move on," as the policeman advised me. I thumped at the door of the next public, and resolved for once not to trumpet forth the naked truth, but try what a little manœuvring would do. This landlord had also retired, but he politely threw up his window, stating "it was too late to serve." "I shall be extremely obliged if you will refresh a traveller; I am late, I know, but I will pay liberally." "*Well, I tell'e what you do,*" said he, "*you try the next house lower down, they serve such g'men as you, and are not tic'lar.* Now, in a true spirit of justice I should avow and explain just what I said and did at this irritating period of my existence. I would rather pass it over, though, and merely observe that, in a boiling rage, and with a parched tongue, I found myself treading my way back from where I came—that is, to the open fields, without even knowing in what county they were situated.

On reaching my car I resolved to make up a sort of bed, and rough it. Some ballast-bags served for a pillow, and I closed in the basket with the folds of the balloon, and thus boasted silken curtains. Stretching out full length, my feet came in contact with a small basket, which up to this time I had forgotten. How I came by this, and what it contained, I must tell you. Whenever I ascended from the New Globe Pleasure-gardens, it was the considerate habit of Mr. Gardner, sen., to provide me with something to comfort the inner man. True to his invariable practice, he had slipped in the little basket, and never shall I forget how acceptable and palatable were its contents. There were some nice beef sandwiches, a little brandy-and-water, and a cigar-case. Hurrah, said I, as I moistened my tongue; bravo, Mr. Gardner, a friend in need is a friend indeed. And then, the cigars—if ever I enjoyed my cigar and a wee drop of cold without, it was on that identical night, when, Robinson Crusoe like, I lay ensconced in a strange county, without even a man Friday to assist me. Having finished my repast, and tried in vain to slumber, I thought I heard voices, and sure enough on removing the curtain I caught some undertoned accents in an adjacent field. Immediately I sung out, "Here, my boys, give a friend a help, will you?" but all I heard were fast receding footsteps, which induced me to come to the severe conclusion that *some* dishonest people there certainly were in the neighbourhood, and that these were poachers—perhaps, though, I was wrong,—at any rate they were not on the same business as myself, or they would not have bolted. I then remained in my sentry-box until six o'clock in the morning, when I heard some workmen on their way to the fields.

The balloon and car had already attracted them, so I lay still until they were at hand. On jumping up, like Jack-in-box, the worthies looked perfectly bewildered; two ran off, and the rest were powerless as to speech. "Why, lads, it's a balloon," said I; "don't be frightened." "*And what be you?*" inquired the bravest of the lot. "Why, the aeronaut, to be sure; the party who goes up." "Ah," said he, "*I thought you wa'ant a mortal man.*" "But I am though, feel me," said I. "*No, da'angd if I come any closer;*" and immediately a side movement was made for the gate. After a deal of fuss and explanation, I got to a farmhouse, when the host heard my tale, but was remarkably distant until he had laid hands on the balloon, and examined the car. Nobody could then be more friendly or hospitable. This farmer informed me that I was down in Hampshire, about twenty miles from Basingstoke. He took both me and my luggage to the nearest railway station, and, on passing through the village, we learnt that it had been visited about a fortnight previously by a gang of the swell mob, and that all strangers were looked upon with suspicion ever since. The landlords apologised for their abruptness; but, "*Lord love ye, sir, a man coming out of the clouds, what could he expect on this here wicked earth?*"

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During the eventful year 1852, the agriculturists of Essex were said to be worked up to a high pitch of exasperation by the frequent visits of aeronauts, who not only spread over their crops like a swarm of locusts, but actually had the audacity to bring with them live cattle, in the shape of bulls, calves, and horses (Madame Poitevin's ascents with animals are here alluded to). These predatory incursions were said to be of French origin, as a Monsieur Winepot, or Portwine, or some such name, had brought down into Essex divers animals, and had even on one occasion tried hard to upset East Ham Church, when, in his Quixotic attack, he thumped away with twenty-five assistants, and was only successful in knocking down gravestones and maiming his own company. The farmers therefore formed a club, with the fierce intention of spreading man-traps, spring guns, and other deadly weapons, with a view of scaring away these robbers of the air, who broke in upon their retirement, and induced idle people to trample underfoot their best crops. The club is said to have sprung up, not so much from the inventive genius of the Essex farmers, as from the craft and subtlety of Messrs. Flint and Steel, two legal advisers, who imagined in these intrusions sufficient grounds for action-at-law. Several most interesting meetings

by the farmers took place, not a hundred miles from Rainham; and a winged reporter, a friend of mine, managed to dot down the heads of some speeches which were made prior to the breaking up of the club.

On the 1st of April it was moved by Flint, that as the locusts might soon be expected, the traps should be looked to, and duly set: seconded by Steel. Mr. Steel, in supporting so protective a measure, said he felt quite certain that if proper firmness were displayed by the prosecutors, the aerial tribes would be driven away, and finally exterminated. He called upon Mr. Goodacre, and particularly upon Mr. John Bull, to display firmness; and commended Mr. Stingingnettle for his able exertions when he ran four miles in chase of a balloon, but was unfortunate enough to find it had come down alone.

Mr. John Bull declined having anything more to do with the club—in short, he meant to retire. He was free to confess that his conscience had upbraided him ever since he was a party to the seizure of a balloon, and to demand compensation for the injury of some buttercups. Gentlemen present very well knew that it was the careless villagers who had done the entire damage. If one's own neighbours wouldn't respect your property, much less would strangers and foreigners.

The Rev. Mr. Fussy, on the part of his parishioners, adverted to the temptation to go astray by these balloons.

Mr. John Bull: "Which temptation your Reverence should teach them to resist, not encourage them to fall into. Having," continued Mr. Bull, "duly considered the objects, intentions, and doings of this club, he begged to withdraw, as it was unworthy of a British farmer to resist that which fell from the clouds."

This is a quaint notice from my friend, the winged reporter, and I really believe Mr. Bull fairly represents our English farmers, who are part of our national pillars and our pride.

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During the autumn of 1849 I visited Hamburg, and obtained permission to ascend. I was much struck with the extraordinary preparations made by the authorities for the preservation of order. The grounds were surrounded by cavalry, infantry, and police, and the whole scene was martial and imposing. I think it was my third voyage when the balloon was driven to and fro by shifting currents, that we lost sight of the earth, owing to a tier of dense clouds, and came down rather unexpectedly upon the country people. Our position was in Holstein, near a village thirty miles from Hamburg; and at this time the war was raging betwixt the Holsteiners and Danes. I had three passengers in the car, who were watching the fields as we descended, when at an altitude of about six hundred feet, pop, pop, bang, bang, bang, went some guns, the hissing whirl of the bullets acting as telltales in the air. "*Why, the people are shooting!*" exclaimed one of the gentlemen. "*Nonsense!*" cried I, "*they honour us with a salute; but keep your heads inside the car, and put out ballast.*" This order obeyed, bang came another volley, but none of us were hit. "Dies mal is die luft-ballon caput," cried one of our party; "this time the balloon is torn." "*Nothing of any consequence,*" said I; "*for you know it becomes the captain to inspire confidence, even if the ship is sinking.*" Certainly a few shot-holes were observable, like stars, through the balloon; but these, in proportion to the volume of gas contained, amounted to no considerable outlet, and not sufficient to bring us down while we had ballast to discharge. A council of war was now held in the vapoury embraces of a dark cloud, when it was decided that we should descend as quickly as consistent with safety, shouting as we approached the earth that we were friends from Hamburg. This last exploit answered admirably. We were down and anchored before anybody assembled. Our mission and starting-point duly intimated, and ourselves on friendly terms with the country people. Those who came up afterwards freely confessed that, supposing we were spies from the Danish camp, they deliberately shot at the balloon—a liberty we deemed it expedient politely to excuse. This was a curious adventure to tell in Hamburg, and my companions made the most of it.

The same year I made a long stay at Berlin, ascending frequently from the far-famed Krolls Winter Garden. Here I exhibited a plan for bombarding a fortress with concussion shells. The apparatus was on a limited scale for public display, but the aerial bombardment attracted great attention, and General Wrangel, then commandant of the military forces in the Prussian capital, signified his intention of witnessing my experiments. Just at this time the political horizon bore a threatening aspect, as we well remember. Berlin was in a state of siege, and all out-door amusements were carefully regulated, lest the masses came too thickly together and plotted mischief. As General Wrangel was conspicuous in suppressing the revolution of 1848, the people held him in disrepute; and as he rode through the Tier Garten, his carriage was stoned. A row immediately ensued, and the military were called out to restore order. The ascent of the balloon, however, did more for the dispersion of the mob than fixed bayonets. The day following I was to have made another trip, but early in the morning. Herr von Hinkeldey, the President of the Police, who has since fallen in a duel, sent down a posse of constables to order that I would remove my balloon, as it attracted riotous people in the Thier Garten. In Germany, it is of no use resisting Government officials, so I politely assented to their wishes, and begged they would permit me to remove the

"Sylph" my own way. As to opening the valve and starting the gas into the air, that would never do; so I whispered a friend to help me fasten on the car, and presently we mounted aloft. The next day I waited upon Herr von Hinkeldey, and pleaded for an extension of his favours, and I can speak highly as to his energy of character and first-rate reputation.

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Another adventurous incident in Germany is a voyage of nearly two hundred miles, which I accomplished with gentlemen of the name of Henkel and Herr Hildebrandt, the Hof-maler or artist to the King of Prussia. We started from the Schutzenhaus-grounds in Berlin, the wind being high and the firmament murky. After we had been up twenty minutes, I pointed out the River Oder. "So soon!" cried Herr Hildebrandt. "Why we must be travelling at railway speed, for that part of the Oder is more than twenty-seven English miles from the city." Sure enough we were going at a rapid rate, so I told the voyagers they must make up their minds how far they would travel, as a few minutes might cost them an additional thaler to ride back. "Never mind," said they, "let us go as far as possible." "That is before dark," said I, "as by that time we shall make a pretty extensive journey." After calculating, singing, joking, gazing, and feasting, we betook ourselves to the descent. But where were we? that was a question which neither of the Germans could answer. We had seen the Baltic, and were progressing towards Dantzic; but the locality beneath us was barren and strange, and darkness, too, was setting in apace. The squally weather remaining unchanged, we experienced a rather rough landing, but still without the least casualty. Whilst approaching *terra firma*, I observed a distant light, which I supposed to indicate a dwelling. When we had emptied the balloon, we agreed to walk off in three opposite directions, and on arriving at a road to give a signal. Neither of us being fortunate enough to discover a track, we all returned, when we determined to start off together in the direction of the light. Two miles' walk brought us to a princely residence, where we requested an interview with the master. "He is a baron," said the gate-keeper, "*and don't care to see people who are strangers.*" "*We are from the upper regions,*" explained Herr Hildebrandt, "*and have come by balloon from Berlin.*" "*Beware how you trifle with an old soldier!*" cried the keeper, somewhat disconcerted. "*I am stating the truth, and request that you present my card.*" After parleying for some time, a large piece of silver, I shrewdly guess, was placed by the side of the card. It then soon reached the Baron, who came forth and heard our account of ourselves. What with our careless appearance and late hours, the Baron disbelieved our tale. "Please to look at my card, Herr Baron," cried Henkel; "And at my passport," said I, which I always took with me. Our papers examined, the next thing was, "Where is your balloon, gentlemen?" "It lies in a field some half-hour's walk from here." Further doubts arose; fresh difficulties sprung up; when, at the instigation of the Baron himself, a band of work-people was formed within the baronial walls, and away we started, ourselves in advance, and the stalwart troop in the rear, ready to assist us if our report were true, or secure us if false. When we arrived at the place of descent it was quite dark, and we looked in vain for some time with lanterns. Hildebrandt predicted where it lay; Henkel guessed; but I was at once for a practical alternative. What was it? Why, to nose it, like hounds, as the silk always retains the powerful odour of gas. Accordingly we opened out as for a hunt, and my own practised nasal organ had the good fortune to catch first scent. The balloon discovered, the Baron shook hands. And we slept at the hall, and were feasted like lords.

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### SCENES FROM THE BALLOON CAR IN THE YEAR 1859.

The concluding *al fresco* fêtes at the Crystal Palace were accompanied by two interesting aerial voyages by Mr. Coxwell. The following is the aeronaut's narrative, extracted from his Diary:—

Ballooning has just been introduced at the Crystal Palace with entire success, and I have reason to be proud that my representations on this subject to the manager were, after some little hesitation, acted upon with becoming spirit.

*October* 18*th*, 1859.—My first ascent from the Palace Park took place this day. Owing to the lateness of the season we had a hazy afternoon, and there was nothing very remarkable in the aspect of the earth's surface; but ample amends were made by witnessing a splendid cloudscape, which presented itself above.

I had three passengers, Mr. Ingelow, Mr. John Allan, and Master Bucknall. On first rising a thick mist surrounded the car; but, at an altitude of six hundred feet above the place of starting, a strongly defined nebulous mass unfolded itself, and ultimately appeared to be a widely-extended range of *cumuli*.

In passing through these clouds I formed a rough estimate of their thickness, and prepared my fellow-voyagers for a transition at once sudden and imposing. At an elevation of one thousand four hundred feet a flood

of light broke upon us, and we rose through the dome of a magnificent cloud, and entered upon a scene of surpassing grandeur. It was not a finely-tinted autumnal picture, such as cloudland sometimes offers when the declining sun imparts ruby lustre to the western sky, but a plain, uniform ocean of fleecy clouds, which rolled along with the utmost regularity to a vast expanse, shutting out all view of the earth, and resembling a sea of vapour agitated by a gentle breeze. The entire upper regions appeared to be in a state of repose; a few *cirri* were observable high overhead, but they had peaceful tails and a fine-weather contour. A few lines from Bloomfield occurred to me as admirably descriptive of the view:—

For yet above these wafted clouds are seen
(In a remoter sky still more serene)
Others, detach'd in ranges through the air,
Spotless as snow, and countless as they're fair;
Scatter'd immensely wide from East to West,
The beauteous semblance of a flock at rest,
These to the raptur'd mind aloud proclaim
The mighty Shepherd's everlasting name.

One of our party had just returned from Switzerland with vivid recollections of Alpine travels. The balloon view, he protested, was much superior to mountain scenery, as looked upon from one of their tops; whilst cloudland was superlatively grander, embracing all the bold and beautiful features, with the advantage of being raised into the very midst of the clouds by almost fairy means, and altogether without personal exertion and inconvenience —two results which not unfrequently mar the brightest pleasures.

So exhilarated was Mr. Ingelow, that he volunteered a song, which led to a regular aerial concert, our respective voices harmonising tolerably well, or appearing to do so in that silent space where the vocalists were at once audience, critics, and performers. After singing, we transacted a little business with the instruments at our disposal, dotting down height, temperature, humidity, and all the facts and figures enumerated in the following table.

* * * * * * * *

Soon after five o'clock the silence which reigned around was wantonly disturbed by Mr. Allan, who essayed to experimentalise upon the effects of echo and the propagation of sound. He asked permission to shout, and it was readily granted. First he hallooed up the neck or safety-valve, which caused the distended sphere to throw back his jocular questions with a shrill tone; then he hailed the unseen inhabitants below, albeit we were far too high to hold intercourse, although it is astonishing at what an elevation questions have been put and replied to. Thus gaily but slowly we sailed along, until the shades of evening stole a march upon us, when it became prudent to descend. On approaching the cloud-tops, they assumed their full and ample dimensions. Here we lingered a while in sportive gambols with the ornaments of the sky, observing their changeful forms and "airy nothings" until they closed round the balloon, and left us to indulge in expectation as to what part of the country would appear to us after an absence of more than an hour and a half.

During the passage of the clouds, a railway locomotive greeted us with its shrill cry of dismay, and as it was unaccompanied by the rolling sound of a train in motion, we concluded that a station must be directly underneath. The moments we spent on the look-out for the first glimpse of *terra firma* afforded agreeable excitement. Two of us sounded the signal of discovery simultaneously; we had sighted a meandering piece of water, which shone brightly on the dim landscape. Presently a sprinkle of gas-lamps twinkled forth, and then we heard a shouting, and ascertained that we were over a small town. As there was no perceptible under-current, we remained stationary, or appeared to do so, for several minutes. On interrogating the people below, who cordially invited us down, as to the name of the place, we learnt it was Epsom.

For prudential motives a half-bag of finely-sifted sand was sent down instead of ourselves, and we re-entered the clouds a quarter of an hour later, during which time the steam whistle was frequently heard; we tried our position for the second time, but there was no indication of a change, and it was determined to seek a ground breeze by dropping down within a few hundred feet of the house-roofs. Here a northerly current befriended us, and the "Queen" moved under its influence at a brisk pace, until a favourable place for landing presented itself about two miles from Epsom, where we alighted at six o'clock, it being then dark.

### THE "QUEEN" IN A GALE.

Tuesday, October 25, was one of those days when aeronauts would rather be within doors by a genial fire than doing duty in the crisp air, with an inch or two of snow under their feet. Such was the state of the ground during the commencement of the inflation, but the day wore on tranquilly until about 2 o'clock, when the

surrounding foliage bent to a fitful gust, which came upon us without warning, and soon increased to a half gale. There was an ominous bluish haze to windward, too, and the barometer had been falling since noon.

No sooner had I got my cordage and network secured, than it became evident we were to have a stormy evening. At half-past 3 o'clock, the great fountains having begun to play, I attempted to move the "Queen" (my balloon) before the central transept, and although, at fewest, fifty soldiers assisted, it being the Balaclava *fête*, yet so overpowering had the wind become, that we were compelled to come to a dead halt, and arrange the ascent from the archery-ground.

As it was of the utmost importance to get away as quickly as possible, I turned a deaf ear to three or four candidates for an ascent, but at last agreed to take one gentleman (Mr. Candler) who would not be denied a seat, notwithstanding the boisterous state of the day. Admiring his courage, I ordered him to "jump in," and, directly the first lull favoured us, I pulled the trigger, and away we went at a tremendous pace, bounding past the great north tower, which stands three hundred feet over the place of starting.

Three minutes had hardly elapsed before we were working through the lower tier of leaden clouds, whilst the rain was pouring down in torrents. "Let her rise," said I, in answer to a question put by my companion; "we may possibly escape water as we get higher." Sure enough we did, for in another minute Mr. Candler drew my attention to snow. We were now rapidly clearing cloud after cloud of dense and threatening appearance. At this elevation we must either have struck into an opposite current or entered a sort of whirlwind, as the balloon began to rock perceptibly, which is altogether unusual. We could hear, too, a humming sound among the network. At six thousand feet up we found ourselves sailing along in a clear area of about a mile each way, with clouds beneath, above, and around us. This was a forbidding, wild-looking space, where the wrathful vapours hovered hard by and seemed to meet for mischief, and there twist themselves into strange and diversified combinations.

Directly under the car was a formidable looking *nimbus*, which we must needs penetrate to obtain sight of the earth. It was of no use flinching, and it was moreover expedient to curtail our run, as the storm increased every minute, so down we dipped for another shower-bath, when the rain rattled, and new forms of cloud closed around us, and appeared to draw the "Queen" into a yawning gulf, and there award us a thorough drenching.

> Still over head
> The mingling tempest weaves its gloom, and still
> The deluge deepens.

If enough is as good as a feast of any one particular liquid, it is surely that of pelting rain. To get out of it I hastened our descent, and prepared for a rough one. As we neared the meadows they all appeared in full gallop, and the motion looked as if it was on their part instead of ours. The grapnel made its first grip in the centre of a grass-field, buried its prongs in the wet soil, and hurled a mass of clod in the air, like a sixty-eight pound shot. It then made a dash at a thick hedge, but broke away and bobbed for the next. Here I espied a ditch, well banked and thickly wooded in the rear. "Look out! she'll hold there; and steady yourself by the hand-lines." Mr. Candler obeyed orders to the letter, and the next moment we were full strain on the cable, whilst the balloon plunged and dived as if she would break through all restraint and be off again. This was the critical point. To let out gas, or retain it, in case of a fresh start? that was the question demanding immediate action. Having confidence in my tackling, I proceeded to exhaust. After several ineffectual struggles, the "Queen" rolled her head down upon the grass, when her last throes became fainter and fainter, until she finally assumed the pancake form, which was equivalent to an intimation that her aerial majesty was ready to enter her carriage in a more compact and undignified state than she was in on quitting the Sydenham Palace. It soon transpired that we had descended at Hayes, near Uxbridge, and that the time occupied in going that distance was about twenty minutes.

Wet and weary, we made for the "Adam and Eve," where mine host and his considerate wife provided us with a refreshing cup of tea and an ample supply of dry clothing.

During this gale the "Royal Charter" was lost, but the "Queen" happily rode it out unscathed.

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## NOTES.

CHAP. VIII. p. 281.—Colonel MacDougall, in 'Modern Warfare as influenced by Modern Artillery' (London, 1864), speaks thus of the service rendered to the Federals by a balloon, in the passage of the Rappahannock, by General Hooker, April, 1863:—

. . . . In another quarter during this day, General Sedgwick having ascertained, by means of a balloon ascent, that a very small force of Confederates and but few guns remained in his front in the Fredericksburg position, attacked and carried the height.

CHAP. IX. p. 299.—Lord Stanhope, in his 'Life of William Pitt,' gives the following correspondence between Earl Stanhope and the Lords of the Admiralty on Steam Navigation:—

In 1796, as in the preceding year, there were some experiments in Steam Navigation set on foot by Earl Stanhope, and sanctioned by the Lords of the Admiralty. He had induced them to construct a ship in the Thames, and had signed a bond, dated June 30, 1794, with a penalty to himself of 9000*l.*, "to indemnify the public in case the said ship should not answer the purpose of Government." The subject must be owned to be a curious one, as tending to throw some light on the first steps of a gigantic change in the British navy; and the origin of the scheme is summed up as follows in a letter which Earl Stanhope addressed to the Lords of the Admiralty.

"MY LORDS, "Chevening, Dec. 22, 1795.

"Your Lordships no doubt are all of you informed that an *Ambi-Navigator* ship (called the 'Kent') has been constructed by Government for the purpose of ascertaining the efficacy of the important plan, invented by me, of navigating ships of the largest size without any wind, and even against wind and waves; and that on the 30th day of June in the year 1794, I gave a bond to His Majesty relative to that ship and plan. The steam-engine apparatus constructed under my direction, and intended for moving that vessel, is now on board her in Greenland Dock. For several months past I have been making detached experiments in the ship on various parts of the apparatus: for I do not intend to content myself with merely producing a result, but my series of experiments is such as to be intended to establish every part of the subject on clear and irrefragable proofs, and to ascertain demonstratively what is the best possible plan.

"The subject being a new one, the workmen have had everything to learn, and it has taken more time to complete the work than was at first expected. The time mentioned in my bond to be allowed for the making of the experiments is nearly expired. I therefore request your Lordships to add a few more months (such as eight, ten, or twelve) for that purpose, as I take for granted that your Lordships would not deem it either proper or expedient to stop experiments of such consequence in their progress, and at the eve of their conclusion.

"I have the honour to be, &c.,

"STANHOPE."

In reply, on the part of the Board of Admiralty (Dec. 28, 1795), the Secretary, Mr. Evan Nepean, in a liberal spirit, granted the longest period of extension that had been suggested, namely, twelve months. The correspondence which I here select and subjoin took place, as will be seen, near the close of that further term.

EARL SPENCER TO EARL STANHOPE.

"MY LORD, "Admiralty, Nov. 5, 1796.

"The delay which I alluded to in my former letter arose from some doubt whether the experiment which has already been made was sufficient to ascertain the properties of the 'Kent.' In order, therefore, to remove any doubt upon that subject, the Board of Admiralty have determined on trying another experiment for that express purpose; for which (if your Lordship has no objection to it) directions will be immediately given.

"I have the honour, &c.,

"SPENCER."

EARL STANHOPE TO EARL SPENCER.

"MY LORD, "London, Nov. 8, 1796.

"The 'Kent' is at present (whatever it may be hereafter) a Government vessel. The Board of Admiralty therefore have a right, and will do right, to make with her such experiments as they shall deem proper. My consent is not necessary, nor should I refuse it if it were.

"Two things no doubt your Lordship will think it expedient to do. First, that the necessary directions may be immediately given for making those experiments respecting which I shall not interfere. Secondly, that they may be made within a short space of time, inasmuch as your Lordship must be sensible that whilst the vessel is out, no adjustment can be made in the steam apparatus, in order to make the intended experiments with steam.

"That subject is of *far* more importance than the Board of Admiralty seems to be aware of.

"I have the honour, &c.,

"STANHOPE."

EARL SPENCER TO EARL STANHOPE.

"MY LORD, "Admiralty, May 17, 1797.

". . . . The Report of the Navy Board (dated the 6th of this month), to which the Admiralty must pay some attention, is positively against your Lordship's proposal of renewing your bond; but I believe the fairest way will be to transmit to you a copy of it, that your Lordship may have an opportunity of explaining some points which it is possible they may have misconceived.

"You may depend upon my not feeling the most distant intention of trifling with you on this or any other subject, though I certainly do not yet see any reason to alter the opinion I have already expressed, that the method you have imagined of moving ships, independent of wind and tide, will not be found to answer the very great expectations your Lordship appears to have formed of it.

"I have the honour, &c.,

"SPENCER."

The experiments made by the "Kent" were satisfactory to Lord Stanhope; not so to the Navy Board. On the whole the Lords of the Admiralty deemed this trial of Steam Navigation to be conclusive against it, and they required of Lord Stanhope the penalty stipulated in his bond. Their correspondence with him from first to last was conducted in a most honourable spirit, and with perfect fairness of intention. But I think that we may deduce from it their early distrust and disrelish of the scheme We may, I think, infer that the trial was not freely accepted, but was rather by some extraneous cause imposed upon them. If so, the question arises, who imposed it? Considering the political hostility of the projector to the Administration, and his personal estrangement from Mr. Pitt, no party and no family influence are here to be imagined. No other alternative, so far as I can see, remains, than that the Prime Minister, when consulted, urged the trial of the scheme from his own impression of its possible merits. There is, therefore, as I conceive, a strong probability that Mr. Pitt was the earliest of all our statesmen in office who discerned, however dimly in the distance, the coming importance of steam to navigation, and who desired to bring it to the test; and this at the very time when his own First Lord of the Admiralty, in other respects a most judicious administrator, looked down upon the project as an empty dream.

PHRYXUS AND HELLE.

## II.

## THE ATMOSPHERE.

THE few remarks that I will here add on the subject of the Atmosphere, are taken from the 'Book of Knowledge,' published at Glasgow, showing the popular ideas with regard to the wind, &c., in the year 1750; from the 'History of the Intellectual Development of Europe,' by Professor John William Draper, of the University of New York; and from the well-known and very beautiful work of Captain Maury, on the 'Physical Geography of the Sea, and its Meteorology,' a book that cannot too frequently be recommended to all lovers of Nature.

THE BOOK OF KNOWLEDGE, 1750.

*Wind.*

Wind is said to be an exhalation hot and dry, engendered in the bowels of the earth; and being gotten out, is carried sidelong upon the face of the earth, and cannot mount upwards above the middle region of the air, which, by reason of its coldness, doth beat it back; so as by much strife, and by meeting other exhalations rising, its motion is forced to be rather round, than right in its falling; and this makes it a whirl-post or whirlwind, which oftentimes by its violence carrieth many things with it from place to place.

*Earthquakes.*

The ancients affirm that the cause of earthquakes is plenty of wind gotten and confined within the bowels of the earth, which is striving to break forth.

*Thunder and Lightning.*

Thunder and lightning is occasioned by an exhalation hot and dry, and being carried up into the middle region of the air, and there enclosed into the body of a cloud. Now these two contrarieties being thus shut or enclosed into one place together, they fall at variance, whereby the water and fire agree not till they have broken through, so that fire and water fly out of the clouds, the breaking whereof makes that noise which we call thunder, and the fire is lightning.

Draper says:—

The intellectual state of the Mohammedan nations at this epoch is shown by the fragments of the works of their scientific writers that have descended to us.

Among such writers is Alhazen, who lived about A.D. 1100. It appears that he resided both in Spain and Egypt, but the details of his biography are very confused. Through his optical works, which have been translated into Latin, he is best known in Europe. . . . . It is in the discussion of one of these physical problems that his scientific greatness truly shines forth. He is perfectly aware that the atmosphere decreases in density with height; and from that consideration he shows that a ray of light, entering it obliquely, follows a curvilinear path which is concave towards the earth; and that, since the mind refers the position of an object to the direction in which the ray of light from it enters the eye, the result must be an illusion as respects the starry bodies; they appear to us, to use the Arabic term, nearer to the *zenith* than they actually are, and not in their true place.

. . . . With extraordinary acuteness, he applies the principles with which he is dealing to the determination of the height of the atmosphere, deciding that its limit is nearly fifty-eight and a half miles.

All this is very grand. Shall we compare it with the contemporaneous monk miracles and monkish philosophy of Europe? It would make a profound impression if communicated for the first time to a scientific Society in our own age. Nor, perhaps, does his merit end here. If the 'Book of the Balance of Wisdom,' for a translation of which we are indebted to M. Khanikoff, the Russian Consul-General at Tabriz, be the production of Alhazen, of which there seems to be internal proof, it offers us evidence of a singular clearness in mechanical conception for which we should scarcely have been prepared; and, if it be not his, at all events it indisputably shows the scientific acquirements of his age. In that book is plainly set forth the connexion between the weight of the atmosphere and its increasing density. The weight of the atmosphere

was therefore understood before Torricelli. He shows that a body will weigh differently in a rare and in a dense atmosphere; that its loss of weight will be greater in proportion as the air is more dense. He considers the force with which plunged bodies will rise through heavier media in which they are immersed, and discusses the submergence of floating bodies, as ships upon the sea.

. . . . The determinations of the density of bodies, as given by Alhazen, approach very closely to our own: in the case of mercury they are even more exact than some of those of the last century. I join, as doubtless all natural philosophers will do, in the pious prayer of Alhazen, that, in the Day of Judgment, the All-Merciful will take pity on the soul of Abur-Raihân, because he was the first of the race of men to construct a table of specific gravities; and I will add Alhazen's name thereto, for he was the first to trace the curvilinear path of a ray of light through the air. . . . .

The atmosphere.

From observations on the twilight, the elasticity of aerial bodies, and the condensing action of cold, the conclusion previously arrived at by Alhazen was established, that the atmosphere does not extend unlimitedly into space. Its height is considered to be about forty-five miles. From its compressibility, the greater part of it is within a much smaller limit; were it of uniform density, it would not extend more than twenty-nine thousand feet. Hence, comparing it with the dimensions of the earth, it is an insignificant aerial shell, in thickness not the eightieth part of the distance to the earth's centre, and its immensity altogether an illusion. It bears about the same proportion to the earth that the down upon a peach bears to the peach itself.

A foundation for the mechanical theory of the atmosphere was laid as soon as just ideas respecting liquid pressures, as formerly taught by Archimedes, were restored, the conditions of vertical and oblique pressures investigated, the demonstration of equality of pressures in all directions given, and the proof furnished that the force of a liquid on the bottom of a vessel may be very much greater than its weight.

Its mechanical relations.

Such of these conclusions as were applicable were soon transferred to the case of aerial bodies. The weight of the atmosphere was demonstrated, its pressure illustrated and measured; then came the dispute about the action of pumps, and the overthrow of the Aristotelian doctrine of the horror of a vacuum. Coincidently occurred the invention of the barometer, and the proof of its true theory, both on a steeple in Paris and on a mountain in Auvergne. The invention of the air-pump, and its beautiful illustrations of the properties of the atmosphere, extended in a singular manner the taste for natural philosophy.

Its chemical relations.

The mechanics of the air was soon followed by its chemistry. From remote ages it had been numbered among the elements, though considered liable to vitiation or foulness. The great discovery of oxygen gas placed its chemical relations in their proper position. One after another other gases, both simple and compound, were discovered. Then it was recognised that the atmosphere is the common receptacle for all gases and vapours; and the problem whether, in the course of ages, it has ever undergone change in its constitution arose for solution.

The antagonism of animals and plants.

The negative determination of that problem, so far as a few thousand years were concerned, was necessarily followed by a recognition of the antagonism of animals and plants, and their mutually balancing each other; the latter accomplishing their duty under the influence of the sun, though he is a hundred millions of miles distant. From this it appeared that it is not by incessant interventions that the sum total of animal life is adjusted to that of vegetable, but that in this respect the system of government of the world is, by the operation of natural causes and law, a conclusion the more imposing since it contemplates all living things, and includes even man himself. The detail of these investigations proved that the organic substance of plants is condensed from the inorganic air to which that of all animals returns, the particles running in ever-repeating cycles, now in the air, now in plants, now in animals, now in the air again; the impulse of movement being in the sun, from whom has come the force incorporated in plant tissues, and eventually disengaged in our fires, shining in our flames, oppressing us in fevers, and surprising us in blushes.

The winds, their origin and nature.

Organic disturbances by respiration and the growth of plants being in the lowest stratum of the air, its uniformity of composition would be impossible were it not for the agency of the winds and the diffusion of gases, which it was found would take place under any pressure. The winds were at length properly referred to the influence of the sun, whose heat warms the air, causing it to ascend, while other portions flow in below. The explanation of land and sea breezes was given, and in the trade-wind was found a proof of the rotation of the earth. At a later period followed the explanation of monsoons in the alternate heating and cooling of Asia and Africa on opposite sides of the line, and of tornadoes, which are disks of air rotating round a translated axis with a diameter of one hundred or one hundred and fifty miles, the axis moving in a curvilinear track with a progressive advance of twenty or twenty-five miles an hour, and the motions being in opposite directions on opposite hemispheres of the globe.

The equatorial calms and trade-winds accounted for on physical principles, it was admitted that the winds of high latitudes, proverbially uncertain as they are, depend in like manner on definite causes.

With these palpable movements there are others of a less obvious kind. Through the air, and by reason of motions in it, sounds are transmitted to us.

Of sounds, their velocity.

The Alexandrian mathematicians made sound a favourite study. Modern acoustics arose from the recognition that there is nothing issuing from the sounding body, but that its parts are vibrating and affecting the medium between it and the ear. Not only by the air-pump, but also by observations in the rare atmosphere of the upper regions, it was shown that the intensity of sound depends upon the density. On the top of a mountain the report of a pistol is no louder than that of a cracker in the valley. As to the gradual propagation of sounds, it was impossible to observe fire-arms discharged at a distance without noticing that the flash appears longer before the report in proportion as the distance is greater. The Florentine academicians attempted a determination of the velocity, and found it to be 1148 feet in a second. More accurate and recent experiments made it 1089·42 feet at the freezing-point of water; but the velocity, though independent of the density, increases with the temperature at the rate of 1·14 foot for each degree. For other media the rate is different; for water, about 4687 feet in a second, and in cast-iron about ten-and-a-half times greater than in air. All sounds, irrespective of their note or intensity, move at the same velocity, the medium itself being motionless in the mass. No sound can pass through a vacuum. The sudden aerial condensation attending the propagation of a sound gives rise to a momentary evolution of heat, which increases the elasticity of the air, and hence the velocity is higher than 916 feet in a second, otherwise the theoretical rate.

M. Arthur Mangin, in his beautiful work entitled 'L'Air et le Monde Aërien' (Tours, 1865), so well tells the story of the discovery of atmospheric pressure, that I could not desire it in better words:—

The year 1630 will always be memorable for one of those discoveries that begin a new epoch in science. Till that year no one believed that the air had weight, that it exercised, like water, a pressure upon all bodies immersed in proportion to their height and surface. Archimedes, the father of hydrostatics, was ignorant that the laws of water could also be applied to the air.

In the seventeenth century, however, many effects of the atmospheric pressure were known, and were applied in the construction of pumps, ornamental fountains, &c. But instead of attributing this to its true cause, it was explained by the ancient aphorism "*Natura abhorret a vacuo;*" an aphorism that Nature, strange enough, had never denied, because no attempt appears to have been made to force water by this means to a height exceeding thirty-two or thirty-three feet.

The Grand Duke of Florence, in 1630, had this ambitious and princely fancy. Engineers received orders to make pumps in the palace for raising the waters to the upper chambers, that is, to a height which surpassed all preceding hydraulic experiments. The engineers, however, set to work, not doubting that because His Highness the Grand Duke wished the water to ascend, it would be sure to do so. With all care the attempt was made; it answered well so far, and the water ascended thirty-two feet; the pumping was continued, but the obstinate water would not rise higher. Exertions were increased, but in vain. The pipes were examined; not a fault, nor the least fissure whereby the air could penetrate, was discovered; yet the pistons would no longer suck up the liquid. The astonishment of the engineers and surprise of the *savans* of Florence exceeded belief. For the first time Nature deviated from the horror it hitherto expressed of a vacuum.

It was referred to the Grand Duke. He could see but one man in all Italy, and in all Europe, who was capable of explaining so strange an overthrow of fundamental principles: this was Galileo. Galileo, taken unawares, could only solve the problem erroneously. It was the weight, he said, of the water that prevented the liquid from rising higher. He should have said that this was but a lame explanation; but it was necessary for him to say something; it was not possible for him to keep silence in a question of Natural Science. The Grand Duke and the Florentine engineers were content with this reply.

There was at Rome at that time a young professor of the Natural Sciences (twenty-three years of age), named Evangelista Torricelli. He was under the tuition of Castelli, a pupil of Galileo. Notwithstanding the veneration he felt for the great man who was the master of his master, Torricelli thought the explanation given by Galileo of the Florentine phenomenon to be unsatisfactory; he, therefore, endeavoured to discover a more plausible solution. On reflection he was convinced that the pretended horror of Nature at a vacuum was purely imaginary, without foundation as without object; one of those empty phrases which answered many things, and were long the bane of philosophy. If, as Galileo stated, the weight of the water prevented it from rising above thirty-two feet, why did it rise so high? For then the water ascended in spite of and in opposition to its weight! Is there not in this,

*Atlas supports the Heavens on his shoulders.*

asked Torricelli, something analogous to what is observed in the balance by one body poising another? Then he thought of the air, forgotten because unseen, which, being a material substance, must, like all others, have weight, and exercise pressure on all bodies on the surface of the globe. "From this cause one might suppose that the water in the pump would cease to rise, when it was in equilibrium with the external pressure of the atmosphere, and that this point was about thirty-two feet, at the sea-level." This was but a step that genius alone can make, and gives to the discoverer a name that will last with all time.

Nevertheless, to make so novel a presumption certain, so opposed to the ideas of the day, Torricelli was required to verify it by a decisive experiment. If correct, the height of a column of liquid to balance the atmospheric pressure should be in inverse proportion to the density of the liquid. Thus quicksilver, being fourteen times heavier than water, should only rise to about twenty-eight inches.

Passing from reasoning to experiment, Torricelli took a tube of thirty inches, closed at one extremity, filled it with mercury, put his finger on the orifice, turned the tube over in a basin containing mercury, and, then withdrawing his finger, kept the tube in a vertical position.

He watched the mercury descend till it reached a point where it remained stationary, leaving a vacuum above it. The height of the metallic column was found to be about twenty-eight inches. With such a result the young natural philosopher must have been a great master of himself not to have run out from his laboratory into the streets of Rome, and cry, like Archimedes, *ευρηκα*. The experiment of Torricelli, and the correct conclusions he drew from it, produced in the learned world the greatest excitement. The partisans of "the universality of matter" attacked them with fury, whilst the new party, whom we may call "the Defenders of the Vacuum," were a small minority. Pascal was the chief of this party in France, and with such a champion the triumph of this truth could not long be delayed. The celebrated experiment made on the Puy-de-Dôme, after the instructions of Pascal by his brother-in-law, Florin Périer, and repeated in Paris by Pascal himself on the tower of St. Jacques-la-Boucherie, opened the eyes of the blindest and closed the mouths of the most obstinate. "If it happens," cried Pascal, "that the height of the quicksilver is less on the top than at the bottom of the mountain, it necessarily follows that the weight and pressure of the air are the sole cause of the column of quicksilver being suspended, and not Nature's horror of a vacuum, because it is certain that there is a pressure of more air at the bottom of the mountain than at the top; and it is no use to say that nature abhors a vacuum at the base of a mountain more than at the summit."

The difference at the Puy-de-Dôme was three inches, and at St. Jacques' tower two-and-a-half lines, being in exact proportion to their heights, as the Puy-de-Dôme is one thousand metres and St. Jacques' tower is fifty metres.

This proof was therefore decisive.

## THE WINDS.

I.

Ye winds, ye unseen currents of the air,
Softly ye played a few brief hours ago;
Ye bore the murmuring bee; ye tossed the hair
O'er maiden cheeks, that took a fresher glow;
Ye rolled the round white cloud through depths of blue;
Ye shook from shaded flowers the lingering dew;
Before you the catalpa's blossoms flew,
Light blossoms, dropping on the grass like snow.

II.

How are ye changed! Ye take the cataract's sound;
Ye take the whirlpool's fury and its might;
The mountain shudders as ye sweep the ground;
The valley woods lie prone beneath your flight:
The clouds before you shoot like eagles past;
The homes of men are rocking in your blast;
Ye lift the roofs like autumn leaves, and cast,
Skyward, the whirling fragments out of sight.

III.

The weary fowls of heaven make wing in vain,
To escape your wrath; ye seize and dash them dead,
Against the earth ye drive the roaring rain;
The harvest-field becomes a river's bed;
And torrents tumble from the hills around,
Plains turn to lakes, and villages are drowned,
And wailing voices, midst the tempest's sound,
Rise, as the rushing waters swell and spread.

IV.

Ye dart upon the deep, and straight is heard
A wilder roar, and men grow pale, and pray;
Ye fling its floods around you, as a bird
Flings o'er his shivering plumes the fountain's spray
See! to the breaking mast the sailor clings;
Ye scoop the ocean to its briny springs,
And take the mountain billow on your wings,
And pile the wreck of navies round the bay.

BRYANT.

Maury, in his 'Physical Geography of the Sea, and its Meteorology,' makes, among other observations, these remarks concerning the atmosphere:—

The two oceans of air and water.

1. Our planet is invested with two great oceans; one visible, the other invisible; one is underfoot, the other overhead; one entirely envelops it, the other covers about two-thirds of its surface. All the water of the one weighs about 400 times as much as all the air of the other.

4. The air is elastic, and very unlike water. That at the bottom is pressed down by the superincumbent air with the force of about 15 pounds to the square inch, while that at the top is inconceivably light. If, for the sake of explanation, we imagine the lightest down, in layers of equal weight and 10 feet thick, to be carded into a pit several miles deep, we can readily perceive how that the bottom layer, though it might have been 10 feet thick when it first fell, yet with the weight of the accumulated and superincumbent mass, it might now, the pit being full, be compressed into a layer of only a few inches in thickness, while the top layer of all, being uncompressed, would be exceedingly light, and still 10 feet thick; so that a person ascending from the bottom of the pit would find the layers of equal weight thicker and thicker until he reached the top. So it is with the barometer and the atmosphere: when it is carried up in the air through several strata of 87 feet, the observer does not find that it falls a tenth of an inch for every successive 87 feet upward through which he may carry it. To get it to fall a tenth of an inch, he must carry it higher and higher for every successive layer.

Weight of the atmosphere.

5. More than three-fourths of the entire atmosphere is below the level of the highest mountains; the other fourth is rarefied and expanded in consequence of the diminished pressure, until the height of many miles be attained. From the reflection of the sun's rays after he has set, or before he rises above the horizon, it is calculated that this upper fourth part must extend at least forty or forty-five miles higher.

Three-fourths below the mountain-tops.

6. At the height of 26,000 miles from the earth, the centrifugal force would counteract gravity; consequently, all ponderable matter that the earth carries with it in its diurnal revolution must be within that distance, and consequently the atmosphere cannot extend beyond that. This limit, however, has been greatly reduced, for Sir John Herschel has shown, by balloon observations,* that at the height of 80 or 90 miles there is a vacuum far more complete than any which we can produce by any air-pump. In 1783 a large meteor, computed to be half a mile in diameter and fifty miles from the earth, was heard to explode. As sound cannot travel through vacuum, it was inferred that the explosion took place within the limits of the atmosphere. Herschel concludes that the aerial ocean is at least 50 miles deep.

Its height.

8. Chemists who have made the analysis, tell us that, out of 100 parts of atmospheric air, 99·5 consist of oxygen and nitrogen, mixed in the proportion of 21 of oxygen to 79 of nitrogen by volume, and of 23 to 77 by weight. The remaining *half of a part* consists of ·05 of carbonic acid and ·45 of aqueous vapour.

Analysis of air.

17. At the temperature of 60°, the specific gravity of average sea-water is 1·0272,† and the weight of a cubic foot is 64·003 lbs.

Specific gravity of sea-water.

18. With the barometer at 30 in., and the thermometer at 32°, the weight of a cubic foot of dry atmospheric air is 1·291 oz., and its specific gravity ·00129. Such is the difference in weight between the two elements, the phenomena of which give the physical geography of the sea its charms.

Of air.

27. "The weight of the atmosphere is equal to that of a solid globe of lead sixty miles in diameter. Its principal elements are oxygen and nitrogen gases, with a vast quantity of water suspended in them in the shape of vapour, and commingled with these a quantity of carbon in the shape of fixed air, equal to restore from its mass many fold the coal that now exists in the world. In common with all substances, the ocean and the air are increased in bulk, and, consequently, diminished in weight, by heat; like all fluids, they are mobile, tending to extend themselves equally in all directions, and to fill up depressions wherever vacant space will admit them; hence in these respects the resemblance betwixt their movements. Water is not compressible or elastic, and it may be solidified into ice, or vaporised into steam; the air is elastic; it may be condensed to any extent by pressure, or expanded to an indefinite degree of tenuity by pressure being removed from it; it is not liable to undergo any change in its constitution beyond these, by any of the ordinary influences by which it is affected.

The sea and the atmosphere contrasted.

28. "These facts are few and simple enough; let us see what results arise from them: As the constant exposure of the equatorial regions of the earth to the sun must necessarily there engender a vast amount of heat, and as his absence from the polar regions must in like manner promote an infinite accumulation of cold, to fit the entire earth for a habitation to similar races of beings, a constant interchange and communion betwixt the heat of the one, and the cold of the other, must be carried on. The ease and simplicity with which this is effected surpass all description. The air, heated near the equator by the overpowering influences of the sun, is expanded and lightened; it ascends into upper space, leaving a partial vacuum at the surface to be supplied from the regions adjoining. Two currents from the poles toward the equator are thus established at the surface, while the sublimated air, diffusing itself by its mobility, flows in the upper regions of space from the equator toward the poles. Two vast whirlpools are thus established, constantly carrying away the heat from the torrid

Influence of the sun.

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* Those of Mr. Welsh, in his ascent from Kew.

† Maury's 'Sailing Directions,' vol. i. Sir John Herschel quotes it at 1·0275 for 62°.

toward the icy regions, and, there becoming cold by contact with the ice, they carry back their gelid freight to refresh the torrid zone.

Powers of the air.

38. "We have already said that the atmosphere forms a spherical shell, surrounding the earth to a depth which is unknown to us, by reason of its growing tenuity, as it is released from the pressure of its own superincumbent mass. Its upper surface cannot be nearer to us than fifty, and can scarcely be more remote than five hundred miles. It surrounds us on all sides, yet we see it not; it presses on us with a load of fifteen pounds on every square inch of surface of our bodies, or from seventy to one hundred tons on us in all, yet we do not so much as feel its weight. Softer than the finest down, more impalpable than the finest gossamer, it leaves the cobweb undisturbed, and scarcely stirs the lightest flower that feeds on the dew it supplies; yet it bears the fleets of nations on its wings around the world, and crushes the most refractory substances with its weight. When in motion, its force is sufficient to level with the earth the most stately forests and stable buildings, to raise the waters of the ocean into ridges like mountains, and dash the strongest ships to pieces like toys. It warms and cools by turns the earth and the living creatures that inhabit it. It draws up vapours from the sea and land, retains them dissolved in itself or suspended in cisterns of clouds, and throws them down again, as rain or dew, when they are required. It bends the rays of the sun from their path to give us the aurora of the morning and twilight of evening; it disperses and refracts their various tints to beautify the approach and the retreat of the orb of day. But for the atmosphere, sunshine would burst on us in a moment and fail us in the twinkling of an eye, removing us in an instant from midnight darkness to the blaze of noon. We should have no twilight to soften and beautify the landscape, no clouds to shade us from the scorching heat; but the bald earth, as it revolved on its axis, would turn its tanned and weakened front to the full and unmitigated rays of the lord of day.

Its functions.

39. "The atmosphere affords the gas which vivifies and warms our frames; it received into itself that which has been polluted by use, and is thrown off as noxious. It feeds the flame of life exactly as it does that of the fire. It is in both cases consumed, in both cases it affords the food of consumption, and in both cases it becomes combined with charcoal, which requires it for combustion, and which removes it when combustion is over. It is the girdling encircling air that makes the whole world kin. The carbonic acid with which to-day our breathing fills the air, to-morrow seeks its way round the world. The date-trees that grow round the falls of the Nile will drink it in by their leaves; the cedars of Lebanon will take of it to add to their stature; the cocoa-nuts of Tahiti will grow rapidly upon it; and the palms and bananas of Japan will change it into flowers. The oxygen we are breathing was distilled for us some short time ago by the magnolias of the Susquehanna and the great trees that skirt the Orinoco and the Amazon; the giant rhododendrons of the Himalayas contributed to it, and the roses and myrtles of Cashmere, the cinnamon-tree of Ceylon, and the forest, older than the flood, that lies buried deep in the heart of Africa, far behind the Mountains of the Moon, gave it out. The rain we see descending was thawed for us out of the icebergs which have watched the Polar Star for ages, or it came from snows that rested on the summits of the Alps, but which the lotus lilies have soaked up from the Nile, and exhaled as vapour again into the ever-present air."

Likened to a machine.

200. There is no employment more ennobling to man and his intellect than to trace the evidences of design and purpose, which are visible in many parts of the creation. Hence, to the right-minded mariner, and to him who studies the physical relations of earth, sea, and air, the atmosphere is something more than a shoreless ocean, at the bottom of which he creeps along. It is an envelope or covering for the distribution of light and heat over the surface of the earth; it is a sewer into which, with every breath we draw, we cast vast quantities of dead animal matter; it is a laboratory for purification, in which that matter is recompounded, and wrought again into wholesome and healthful shapes; it is a machine for pumping up all the rivers from the sea, and for conveying the water (§ 191) from the ocean to their sources in the mountains; it is an inexhaustible magazine, marvellously stored. Upon the proper working of this machine depends the well-being of every plant and animal that inhabits the earth. How interesting, then, ought not the study of it to be! An examination of the uses which plants and animals make of the air is sufficient to satisfy any reasoning mind in the conviction that when they were created, the necessity of this adaptation was taken into account. The connexion between any two parts of an artificial machine that work into each other, does not render design in its construction more patent than is the fact that the great atmospherical machine of our planet was constructed by an Architect who designed it for certain purposes; therefore the management of it, its movements, and the performance of its offices, cannot be left to chance. They are, we may rely upon it, guided by laws that make all parts, functions, and movements of this machinery as obedient to order and as harmonious as are the planets in their orbits.

The air and the ocean governed by stable laws.

201. Any examination into the economy of the universe will be sufficient to satisfy the well-balanced minds of observant men that the laws which govern the atmosphere and the laws which govern the ocean (§ 164) are laws which were put in force by the Creator when the foundations of the earth were laid, and that therefore they are laws of order; else, why should the Gulf Stream, for instance, be always where it is, and running from the Gulf of Mexico, and not somewhere else, and sometimes running into it? Why

should there be a perpetual drought in one part of the world, and continual showers in another? Or why should the conscious winds ever heed the voice of rebuke, or the glad waves ever "clap their hands with joy"?

Importance of observing the works of Nature.

202. To one who looks abroad to contemplate the agents of Nature, as he sees them at work upon our planet, no expression uttered or act performed by them is without meaning. By such a one, the wind and rain, the vapour and the cloud, the tide, the current, the saltness, and depth, and warmth, and colour of the sea, the shade of the sky, the temperature of the air, the tint and shape of the clouds, the height of the tree on the shore, the size of its leaves, the brilliancy of its flowers—each and all may be regarded as the exponent of certain physical combinations, and therefore as the expression in which Nature chooses to announce her own doings, or, if we please, as the language in which she writes down or elects to make known her own laws. To understand that language and to interpret aright those laws is the object of the undertaking which we now have in hand. No fact gathered from such a volume as the one before us can therefore come amiss to those who tread the walks of inductive philosophy; for, in the handbook of Nature, every such fact is a syllable; and it is by patiently collecting fact after fact, and by joining together syllable after syllable, that we may finally seek to read aright from the great volume which the mariner at sea as well as the philosopher on the mountain each sees spread out before him.

Materials for this chapter.

203. There have been examined at the Washington Observatory more than a million of observations on the force and direction of the winds at sea.* The discussion of such a mass of material has thrown much light upon the circulation of the atmosphere; for, as in the ocean (§ 201), so in the air, there is a regular system of circulation.

"BLOW, WIND, AND CRACK YOUR CHEEKS! RAGE! BLOW!"
*King Lear*, Act III. scene 2.

* Nautical Monograph, No. 1, 1859.

Perhaps *Lux Oritur* might be more correct in this woodcut.

DIAGRAM ILLUSTRATING

# THE CIRCULATION OF THE WINDS ROUND THE GLOBE.

DESIGNED BY LIEUT. MAURY, LL.D., LATE OF THE WASHINGTON OBSERVATORY.

As there are constant currents in the ocean, so are there regular currents in the atmosphere. From the parallel of about 30° north and south, nearly to the equator, we have, extending entirely round the earth, two zones of perpetual winds, viz., the zone of the north-east trades on this side, and of the south-east on that. With slight interruptions, they blow perpetually, always moving in the same direction, except when they are turned aside by a desert here and there to blow as monsoons, or as land and sea breezes. As these two main currents of air are constantly flowing from the poles towards the equator, we are safe in assuming that the air which they keep in motion must return by some channel to the place towards the poles whence it came, in order to supply the trades. If this were not so, these winds would soon exhaust the polar regions of atmosphere, and pile it up about the equator, and then cease to blow for the want of air to make more wind of.

This return current, therefore, must be in the upper regions of the atmosphere, at least until it passes over those parallels between which the trade-winds are always blowing on the surface. The return current must also move in the direction opposite to that wind the place of which it is intended to supply. These direct and counter currents are also made to move in a sort of spiral or loxodromic curve, turning to the west as they go from the poles to the equator, and in the opposite direction as they move from the equator toward the poles. This turning is caused by the rotation of the earth on its axis.

The earth, we know, moves from west to east. Now, if we imagine a particle of atmosphere at the north-pole, where it is at rest, to be put in motion in a straight line toward the equator, we can easily see how this particle of air, coming from the very axis of diurnal rotation, where it did not partake of the diurnal motion of the earth, would, in consequence of its *vis inertia*, find, as it travels south, the earth slipping from under it, as it were, and thus it would appear to be coming from the north-east and going toward the south-west; in other words, it would be a north-east wind.

On the other hand, we can perceive how a like particle of atmosphere that starts from the equator, to take the place of the other at the pole, would, as it travels north, in consequence of its *vis inertia*, be going toward the east faster than the earth. It would therefore appear to be blowing from the south-west, and going towards the north-east, and exactly in the opposite direction to the other. Writing south for north, the same takes place between the south pole and the equator.

Such is the process which is actually going on in nature; and if we take the motions of these two particles as the type of the motion of all, we shall have an illustration of the great currents in the air, the equator being near one of the nodes, and there being at least two systems of currents, an upper and an under between it and each pole.

Let us now return to our northern particle, and follow it in a round from the north pole across the equator to the south pole, and back again. (See Diagram). Setting off from the north polar regions, at P, this particle of air, instead of travelling on the surface all the way from the pole to the equator, travels in the upper regions of the atmosphere (A) till it gets near the parallel of 30°. Here it meets, also in the clouds, the hypothetical particle that is coming from the south, and going north to take its place. About this parallel of 30° north, then, these two particles press against each other with the whole amount of their motive power, producing a calm and an accumulation of atmosphere; this accumulation is sufficient to balance the pressure of the two winds from the north and south.

From under this bank of calms, which seamen call the 'horse latitudes,' or the 'calms of Cancer,' two surface-currents of wind are ejected; one towards the equator, as the NORTH-EAST TRADES; the other towards the poles, as the SOUTH-WEST PASSAGE WINDS.

These winds come out at the lower surface of the calm region, and consequently the place of the air borne away in this manner must be supplied, we may infer, by downward-currents from the superincumbent air of the calm region. The barometer in this calm region is said to stand higher than it does either to the north or south of it; furnishing another proof of the banking up here of the atmosphere, and pressure from its downward motion.

Following our imaginary particle of air, from the north across this calm belt of Cancer, we now feel it moving on the surface of the earth (B) as the north-east trade-wind; and as such it continues, till it arrives near the equator, where it meets a like hypothetical particle, which, starting from the south pole at the same time the other started from the north, has blown as the SOUTH-EAST TRADE WIND.

Here, at this equatorial place of meeting, there is another conflict of winds, and another calm region, for

a north-east and south-east wind cannot blow at the same time in the same place. The two particles have been put in motion by the same power; they meet with equal force; and, therefore, at their place of meeting, are stopped in their course. Here, therefore, there is a calm belt.

Warmed now by the heat of the sun, and pressed on each side by the whole force of the north-east and south-east trades, these two hypothetical particles, taken as a type of the whole, cease to move onward, and ascend. This operation is the reverse of that which took place at the meeting near the parallel of 30°.

This imaginary particle, then, having ascended to the upper regions of the atmosphere again, travels there (C) counter to the south-east trades, until it meets, near the calm belt of Capricorn, another particle from the south pole; here there is a descent as before; it then flows on toward the south pole as a surface wind (D) from the north-west.

Entering the polar regions obliquely, it is pressed upon by similar particles flowing in oblique currents across every meridian; and here again is a calm place or node; for, as our imaginary particle approaches the parallels near the polar calms more and more obliquely, it, with all the rest, is whirled about the pole in a continued circular gale; finally, reaching the vortex, or the calm place, it is carried upward to the regions of atmosphere above, (F) whence it commences again its circuit to the north as an upper current, (E) as far as the calm belt of Capricorn; here it encounters its fellow from the north; they stop, descend, and flow out as surface currents; the one with which the imagination is travelling, (F) to the equatorial calm, as the south-east trade wind; here it ascends, travelling thence to the calm belt of Cancer, as an upper counter current to the north-east trades. Here it descends and travels as the south-west passage wind (H) towards the pole.

Of course, as the surface winds (H and D) approach the poles, there must be a sloughing off as it were of air from the surface winds, in consequence of their approaching the poles. For as they near the poles, the parallels become smaller and smaller, and the surface current must either extend much higher up, and blow with greater rapidity as it approaches the poles, or else a part of it must be sloughed off above, and so turn back before reaching the calms about the poles. The latter is probably the case.

There are at least two forces concerned in driving the wind through its circuits. The trade winds are caused, it is said, by the intertropical heat of the sun, which, expanding the air, causes it to rise up near the equator; it then flows off in the upper currents north and south, and there is a rush of air at the surface both from north and south, to restore the equilibrium; hence the trade winds. The atmosphere has, however, been invested with another property which increases its mobility, and gives the heat of the sun still more power to put it in motion; and it is this—as heat changes the atmospherical level, it changes also the specific gravity of the air acted upon. If, therefore, the level of the great aërial ocean were undisturbed by the sun's rays, and if the air were adapted to a change of specific gravity alone, without any change in volume, this quality would also be the source of at least two systems of currents in the air, viz., an upper and a lower. The two agents combined, that which changes level or volume, and that which changes specific gravity—give us the general currents under consideration. Hence, we say that the *primum mobile* of the air is derived from change of specific gravity induced by the freezing temperature of the polar regions, as well as from change of specific gravity, due to the expanding force of the sun's rays within the tropics.

The peculiar clouds of the trade winds are formed between the upper and lower currents of air. They are probably formed of vapour condensed from the upper current, and evaporated as it descends by the lower and dry current from the poles. It is the same phenomenon up there which is so often observed here below; when a cool and dry current of air meets a warm and wet one, an evolution of vapour or fog ensues.

We now see the general course of the 'wind in his circuits,' as we see the general course of the water in a river. There are many abrading surfaces and irregularities, which produce a thousand eddies in the main stream; yet, nevertheless, the general direction of the whole is not disturbed nor affected by those counter currents; so with the atmosphere and variable winds.

The Bible frequently makes allusion to the laws of nature, their operation, and effects. But such allusions are so often wrapped in the folds of the peculiar and graceful drapery with which its language is occasionally clothed, that the meaning, though peeping out from its thin covering all the while, yet lies in some sense concealed, until the lights and revelations of science are thrown upon it; then it bursts out and strikes us with exquisite force and beauty. As our knowledge of nature and her laws has increased, so has our understanding of many passages in the Bible been improved. The Psalmist called the earth "the round world;" yet for ages it was the most damnable heresy for Christian men to say the world is round; and, finally, sailors circumnavigated the globe, proved the Bible to be right, and saved Christian men of science from the stake.

And as for the general system of atmospherical circulation which we have endeavoured to describe, the Bible tells it all in a single sentence: "The wind goeth toward the south, and turneth about unto the north; it whirleth about continually, and the wind returneth again according to his circuits."—Eccles. I. 6.

London: James Reynolds, 174, Strand.

229. Let us imagine the air to be visible, that we could see these different strata of winds, and the air as it is sloughed off from one stratum to join the other. We can only liken the spectacle that would be presented between the upper and the lower stratum of these winds to the combing of a succession of long waves as they come rolling in from the sea, and breaking one after another, upon the beach. They curl over and are caught up, leaving foam from their white caps behind, but nevertheless stirring up the sea and mixing up its waters so as to keep them all alike.

Supposing the air visible, the spectacle that would be presented between the upper and lower currents.

230. If the ordinances of Nature require a constant circulation and continual mixing up of the water in the sea, that it become not stagnant, and that it may be kept in a wholesome state for its inhabitants, and subserve properly the various offices required of it in the terrestrial economy, how much more imperative must they not be with the air? It is more liable to corruption than water; stagnation is ruinous to it. It is both the sewer and the laboratory for the whole animal and vegetable kingdoms. Ceaseless motion has been given to it; perpetual circulation and intermingling of its ingredients are required of it. Personal experience teaches us this, as is manifest in the recognised necessity of ventilation in our buildings—the wholesome influences of fresh air, and the noxious qualities of "an atmosphere that has no circulation." Hence, continual mixing up of particles in the atmosphere being required of the winds in their circuits, is it possible for the human mind to conceive of the appointment of "circuits" for them (§ 216) which are so admirably designed and exquisitely adapted to the purpose as are those which this view suggests?

The importance of atmospherical circulation.

234. By the motion of the clouds upper currents of wind are discerned in the sky. They are arranged in layers or strata one above the other. The clouds of each stratum are carried by its winds in a direction and with a velocity peculiar to their stratum. How many of these superimposed currents of wind there may be between the top and bottom of the atmosphere we know not. As high up as the cloud-region several are often seen at the same time. They are pinions and rachets in the atmospherical machinery. We have seen (§ 230) some of their uses: let us examine them more in detail. Now, as the tendency of air in motion is (§ 120) to move in arcs of great circles, and as all great circles that can be drawn about the earth must cross each other in two points, it is evident that the particles of the atmosphere which are borne along as wind must have their paths all in *diverging* or *converging* lines, and that consequently each wind must either be, like the trade-winds (§ 222), drawing down and sucking in air from above, or, like the counter trades (§ 226), crowding out and forcing it off into the upper currents.

The upper currents—their numbers and offices.

236. Thus the laws of motion, the force of gravity, and the figure of the earth, all unite in requiring every wind that blows either to force air up from the surface into the regions above, or to draw it down to the earth from the crystal vaults of the upper sky. Add to these the storm-king:—traversing the air, he thrusts in the whirlwind or sends forth the cyclone, the tornado, and the hurricane to stir up and agitate, to mix and mingle the whole in one homogeneous mass. By this perpetual stirring up, this continual agitation, motion, mixing, and circulation, the airy covering of the globe is kept in that state which the well-being of the organic world requires. Every breath we draw, every fire we kindle, every blade of grass that grows or decays, every blaze that shines and burns adds something that is noxious, or takes something that is healthful away from the surrounding air. Diligent, therefore, in their offices must the agents be which have been appointed to maintain the chemical status of the atmosphere, to preserve its proportions, to adjust its ingredients, and to keep them in that state of admixture best calculated to fit it for its purposes.

The results upon its circulation of this tendency.

237. Several years ago the French Academy sent out bottles and caused specimens of air from various parts of the world to be collected and brought home to be analysed. The nicest tests which the most skilful chemists could apply were incapable of detecting any, the slightest, difference as to ingredients in the specimens from either side of the equator; so thorough in the performance of their office are these agents. Nevertheless, there are a great many more demands on the atmosphere by the organic world for *pabulum* in one hemisphere than in the other; and consequently a great many more inequalities for these agents to restore in one than in the other. Of the two, the land of our hemisphere most teems with life, and here the atmosphere is most taxed. Here the hearthstone of the human family has been laid. Here, with our fires in winter and our crops in summer, with our workshops, steam-engines, and fiery furnaces going night and day—with the ceaseless and almost limitless demands which the animal and vegetable kingdoms are making upon the air overhead, we cannot detect the slightest difference between atmospherical ingredients in different hemispheres; and yet, notwithstanding the compensations and adjustments between the two kingdoms of the organic world, there are almost in every neighbourhood causes at work which would produce a difference were it not for these ascending and descending columns of air—were it not for the obedient winds—for this benign system of circulation—these little cogs and rachets which have been provided for its perfect working. The study of its mechanism is good and wholesome in its influences, and the contemplation of it well calculated to excite in the bosom of right-minded philosophers the deepest and best of emotions.

Experiments by the French Academy.

238. Upon the proper adjustments of the dynamical forces which keep up these ceaseless movements the life of organic nature depends. If the air that is breathed were not taken away and renewed, warm-blooded life would cease; if carbon, and oxygen, and hydrogen, and water were not in due quantities dispensed by the restless air to the flora of the earth, all vegetation would perish for lack of food. That our planet may be liable to no such calamity, power has been given to the wayward wind, as it "bloweth where it listeth," to bring down from the pure blue sky fresh supplies of life-giving air wherever it is wanted, and to catch up from the earth wherever it may be found, that which has become stale—to force it up, there to be deflagrated among the clouds, purified and renovated by processes known only to Him whose ministers they are. The slightest change in the purity of the atmosphere, though it may be too slight for recognition by chemical analysis in the laboratory, is sure to be detected by its effects upon the nicer chemistry of the human system, for it is known to be productive of disease and death. No chemical tests are sensitive enough to tell us what those changes are, but experience has taught us the necessity of ventilation in our buildings, of circulation through our groves. The cry in cities for fresh air from the mountains or the sea, reminds us continually of the life-giving virtues of circulation. Experience teaches that all air when pent up and deprived of circulation becomes impure and poisonous.

How supplies of fresh air are brought down from the upper sky.

239. How minute, then, pervading, and general, benignant, sure, and perfect must be that system of circulation which invests the atmosphere and makes "the whole world kin"! In the system of vertical circulation which I have been endeavouring to describe, we see, as in a figure, the lither sky filled with crystal vessels full of life-giving air continually ascending and descending between the bottom and the top of the atmospherical ocean; these buckets are let down by invisible hands from above, and, as they are taken up again, they carry off from the surface, to be purified in the laboratory of the skies, phials of mephitic vapours and noxious gases, with the dank and deadly air of marshes, ponds, and rivers.

Beautiful and benign arrangements.

240. Whenever, by study and research, we succeed in gaining an insight, though never so dim, into any one of the offices for which any particular part of the physical machinery of our planet was designed by the Great Architect, the mind is enriched with the conviction that it has comprehended a thought that was entertained at the creation. For this reason the beautiful compensations which philosophers have discovered in terrestrial arrangements are sources of never-failing wonder and delight. How often have we been called on to admire the benign provision by which fresh water is so constituted that it expands from a certain temperature down to freezing! We recognise in the formation of ice on the top instead of at the bottom of freezing water, an arrangement which subserves, in manifold ways, wise and beneficent purposes. So, too, when we discern in the upper sky (§ 234) currents of wind arranged in strata one above the other, and running hither and thither in different directions, may we not say that we can here recognise also at least one of the fore-ordained offices of these upper winds? That by sending down fresh air and taking up foul, they assist in maintaining the world in that state in which it was made and for which it is designed—"a habitation fit for man"?

Their influences upon the mind.

Reservoirs in the sky.

248. . . . . Thus we infer the existence in the upper air of reservoirs for the heat as well as of chambers for the cold.

The wind in his circuits.

251. We now see the general course of the "wind in his circuits," as we see the general course of the water in a river. There are many abraiding surfaces, irregularities, &c., which produce a thousand eddies in the main stream; yet, nevertheless, the general direction of the whole is not disturbed nor affected by those counter-currents; so with the atmosphere and the variable winds which we find here in this latitude. Have I not, therefore, very good grounds for the opinion (§ 200) that the "wind in his circuits," though apparently to us never so wayward, is as obedient to law and as subservient to order as were the morning stars when first they "sang together"?

Vapour as one of the causes of the trade-winds.

259. Let us consider this influence. A cubic foot of water, being converted into vapour, occupies the space of 1800 cubic feet.* This vapour is also lighter than the 1800 cubic feet of air which it displaces. Thus, if the displaced air weigh 1000 ounces, the vapour will weigh 623; consequently, when air is surcharged with vapour, the atmosphere is bulged out above, and the barometric pressure is diminished in proportion to the volume which flows off above in consequence of this bulging out. Thus, if we imagine the air over the Atlantic Ocean to be all in a state of rest, and that suddenly during this calm, columns of vapour were to commence rising from the middle of this ocean, we can understand how the wind would commence to flow into this central space from all around. Now, if we imagine no other disturbing cause to arise, but suppose the evaporation from this central area to go on with ceaseless activity, we can see that there would be a system of winds in the Atlantic as steady, but perhaps not so strong as the trades, yet owing their existence, nevertheless, merely to the formation of aqueous vapour. But this is not all.

260. "During the conversion of solids into liquids, or of liquids into vapours, heat is absorbed, which is again

* Black and Watt's Experiments on Heat.

given out on their recondensation."* In the process of converting one measure of water into vapour, heat enough is absorbed—*i. e.*, rendered latent, without raising the temperature of the vapour in the least—to raise the temperature of 1000 such measures of water 1°; when this vapour is condensed again into water, wherever the place of recondensation may be, this heat is set free again. If it be still further condensed, as into hail or snow, the latent heat rendered sensible during the process of congelation would be sufficient to raise the temperature of 140 additional measures of water 1°.

Black's law.

261. In this heat rendered latent by the processes of evaporation, and transported hither and thither by the winds, resides the chief source of the dynamical power which gives them motion. In some aspects vapour is to the winds what fuel is to the steam-engine: they carry it to the equatorial calm belt; there it rises, entangling the air, and carrying it up along with it as it goes. As it ascends it expands; as it expands it grows cool; and as it does this its vapour is condensed, the latent heat of which is thus liberated; this raises the temperature of the upper air, causing it to be rarefied and to ascend still higher. This increased rarefaction calls for increased velocity on the part of the inpouring trade-winds below.

The latent heat transported in vapour.

262. Thus the vapours uniting with the direct solar ray would, were there no counteracting influences, cause the north-east and south-east trade-winds to rush in with equal force. But there is on the polar side of the north-east trade-winds an immense area of arid plains for the heat of the solar ray to beat down upon, also an area of immense precipitation. These two sources of heat hold back the north-east trade-winds, as it were, and, when the two are united, as they are in India, they are sufficient not only to hold back the north-east trade-wind, but to reverse it, causing the south-west monsoon to blow for half the year instead of the north-east trade.

The effect of the deserts upon the trade-winds.

268. We now begin to conceive what a powerful machine the atmosphere must be; and, though it is apparently so capricious and wayward in its movements, here is evidence of order and arrangement which we must admit, and proof which we cannot deny, that it performs this mighty office with regularity and certainty, and is therefore as obedient to a law as is the steam-engine to the will of its builder. It, too, is an engine. The South Seas themselves, in all their vast intertropical extent, are the boiler for it, and the northern hemisphere is its condenser (§ 24). The mechanical power exerted by the air and the sun in lifting water from the earth, in transporting it from one place to another, and in letting it down again, is inconceivably great. The utilitarian who compares the water-power that the Falls of Niagara would afford if applied to machinery, is astonished at the number of figures which are required to express its equivalent in horse-power. Yet what is the horse-power of the Niagara, falling a few steps, in comparison with the horse-power that is required to lift up as high as the clouds and let down again all the water that is discharged into the sea, not only by this river, but by all the other rivers and all the rain in the world? The calculation has been made by engineers, and, according to it, the force for making and lifting vapour from each area of one acre that is included on the surface of the earth is equal to the power of thirty horses.

Powerful machinery.

345. Where shall those who are disposed to search, look for this other agent that is supposed to be concerned with the trade-winds in their easting? I cannot say where it is to be found, but considering the recent discoveries in terrestrial magnetism—considering the close relations between many of its phenomena and those both of heat and electricity—the question may be asked whether some power capable of guiding "the wind in his circuits" may not lurk there? Oxygen comprises more than one-fifth part (two-ninths) of the atmosphere, and Faraday has discovered that oxygen is para-magnetic. If a bar of iron be suspended between the poles of a magnet, it will arrange itself axially, and point towards them; but if, instead of iron, a bar of bismuth be used, it will arrange itself equatorially, and point in a direction perpendicular to that in which the iron pointed. To distinguish these two kinds of forces, Dr. Faraday has said iron is para-magnetic, bismuth dia-magnetic. Oxygen and iron belong to the same class, and all substances in nature belong to one or the other of the two classes of which iron and bismuth are the types.

Faraday's discovery of magnetism in the air.

346. This eminent philosopher has also shown that if you place a magnetised bar of iron on a smooth surface, and sift fine iron-filings down upon it, these filings will arrange themselves in curved lines; or, if the bar be broken, they will arrange themselves. The earth itself, or the atmospheric envelope by which it is surrounded, is a most powerful magnet, and the lines of force which proceed whether from its interior, its solid shell, or vaporous covering, are held to be just such lines as those are which surround artificial magnets; proceed whence they may, they are supposed to extend through the atmosphere, and to reach even to the planetary spaces. Many eminent men and profound thinkers, Sir David Brewster among them, suspect that the atmosphere itself is the seat of terrestrial magnetism. All admit that many of those agents, both thermal and electrical,

Lines of magnetic force.

* Black's law. It is an important one, and should be remembered.

which play highly important parts in the meteorology of our planet, exercised a marked influence upon the magnetic condition of the atmosphere also.

The magnetic influences of the oxygen of the air and of the spots on the sun.

347. Now, when, referring to Dr. Faraday's discovery (§ 345), and the magnetic lines of force as shown by the iron-filings (§ 346), we compare the particles of oxygen gas to these minute bits of ferruginous dust that arrange themselves in lines and curves about magnets;—when we reflect that this great magnet, the earth, is surrounded by a para-magnetic gas, to the molecules of which the finest atom from the file is in comparison gross and ponderous matter; that the entire mass of this air is equivalent to a sea of mercury covering the earth around and over to the depth of thirty inches, and that this very subtile mass is in a state of unstable equilibrium, and in perpetual commotion by reason of various and incessant disturbing causes; when we reflect farther upon the recent discoveries of Schwabe and of Sabine concerning the spots on the sun and the magnetic elements of the earth, which show that if the sun or its spots be not the great fountain of magnetism, there is at least reason to suspect a close alliance between solar and terrestrial magnetism; that certain well-known meteorological phenomena, as the aurora, come also within the category of magnetic phenomena; that the magnetic poles of the earth and the poles of maximum cold are at or near the same spot; that the thermal equator is not parallel to or coincident with either the terrestrial or with that which the direct solar ray would indicate, but that it follows, and in its double curvatures conforms to the magnetic equator; moreover, when we reflect upon Barlow's theory and Fox's observations, which go to show that the direction of metallic veins of the northern hemisphere, which generally lie north-east and south-westwardly, must have been influenced by the direction of the magnetic meridians of the earth or air;—finally, I say, when we reflect upon magnetism in all its aspects, we may well inquire whether such a mass of highly magnetic gas as that which surrounds our planet does not intervene, by reason of its magnetism, in influencing the circulation of the atmosphere and the course of the winds.

The needle in its diurnal variations, the barometer in its readings, and the atmosphere in its electrical tension, all have the same hours for their maxima and minima.

348. *This magnetic sea, as the atmosphere may be called,* is continually agitated; it is disturbed in its movements by various influences which prevent it from adjusting itself to any permanent magnetic or other dynamical status; and its para-magnetic properties are known to vary with every change of pressure or of temperature. The experiments of Faraday show that the magnetic force of the air changes with temperature; that it is least near the equator, and greatest at the poles of maximum cold; that it varies with the seasons, and changes night and day; nay, the atmosphere has regular variations in its electrical conditions expressed daily at stated hours of maximum and minimum tension. Coincident with this, and in all parts of the world, but especially in sub-tropical latitudes, the barometer also has its maxima and minima readings for the day. So also, and at the same hours, the needle attains the maxima and minima of its diurnal variations. Without other timepiece, the hour of the day may be told by these maxima and minima, each group of which occurs twice a day and at six-hour intervals. These invisible ebbings and flowings—the diurnal change in the electrical tension—the diurnal variation of the needle—and the diurnal rising and falling of the barometer—follow each other as closely and as surely, if not quite as regularly, as night the day. Any cause which produces changes in atmospheric pressure invariably puts it in motion, giving rise to gentle airs or furious gales, according to degree; and here, at least, we have a relation between the movements in the air and the movements of the needle so close that it is difficult to say which is cause, which effect, or whether the two be not the effects of a common cause.

The question raised by modern researches.

349. Indeed, such is the nature of this imponderable called magnetism, and such the suggestions made by Faraday's discoveries, that the question has been raised in the minds of the most profound philosophers of the age whether the various forces of light, heat, and gravitation, of chemical affinity, electricity, and magnetism, may not yet be all traced to one common source. Surely, then, it cannot be considered as unphilosophical to inquire of magnetism for some of the anomalous movements that are observed in the atmosphere. These anomalies are many; they are not confined to the easting of the trade-winds; they are to be found in the counter-trades and the calm belts also. There is reason to believe, as has already been stated (§ 288), that there is a crossing of the winds at the calm belts (§ 212), and it was promised to go more into detail concerning the circumstances which seem to favour this belief. Our researches have enabled us, for instance, to trace from the belt of calms, near the tropic of Cancer, which extends entirely across the seas, an efflux of air both to the north and to the south. From the south side of this belt the air flows in a steady breeze, called the north-east trade-winds, towards the equator (see Plate); on the north side of it, the prevailing winds come from it also, but they go towards the north-east. They are the well-known westerly winds which prevail along the route from this country to England in the ratio of two to one. But why should we suppose a crossing to take place here? We suppose so from these facts: because throughout Europe—the land upon which these westerly winds blow—precipitation is in excess of evaporation, and because at sea they are going from a warmer to a colder climate; and therefore it may

be inferred that Nature exacts from them what we know she exacts from the air under similar circumstances, but on a smaller scale, before our eyes, viz., more precipitation than evaporation. In other words, they probably leave in the Atlantic as much vapour as they take up from the Atlantic. Then where, it may be asked, does the vapour which these winds carry along, for the replenishing of the whole extra-tropical regions of the north, come from? They did not get it as they came along in the upper regions, as a counter-current to the north-east trades, unless they evaporated the trade-wind clouds, and so robbed those winds of their vapour. They certainly did not get it from the surface of the sea in the calm belt of Cancer, for they did not tarry long enough there to become saturated with moisture. Thus circumstances again pointed to the south-east trade-wind regions as the place of supply. This question has been fully discussed [in Chapter V. of 'The Physical Geography of the Sea'], where it has been shown they did not get it from the Atlantic. Moreover, these researches afforded grounds for the supposition that the air of which the north-east trade-winds are composed, and which comes out of the same zone of calms as do these south-westerly winds, so far from being saturated with vapour at its exodus, is dry; for near their polar edge, the north-east trade-winds are, for the most part, dry winds.

Wet and dry air of the calm belts.

350. Facts seem to confirm this, and the calm belts of Cancer and Capricorn both throw a flood of light upon the subject. These are two bands of light airs, calms, and baffling winds, which extend entirely around the earth. The air flows out north and south from these belts. That which comes out on the equatorial side goes to feed the trades, and makes a dry wind; that which flows out on the polar side goes to feed the counter-trades (§ 349), and is a rain wind. How is it that we can have from the same trough or receiver, as these calm belts may be called, an efflux of dry air on one side and of moist on the other? Answer: upon the supposition that the air without rain comes from one quarter, that with rain from another—that, coming from opposite directions to this place of meeting, where there is a crossing, they pass each other in their circuits. They both meet here as upper currents, and how could there be a crossing, without an agent or influence to guide them? and why in the search should we not look to magnetism for this agent as well as to any other of the hidden influences which are concerned in giving to the winds their force and direction?

Principles according to which the physical machinery of our planet should be studied.

351. He that established the earth "created it not in vain; He formed it to be inhabited." And it is presumptuous, arrogant, and impious to attempt the study of its machinery upon any other theory: *it was made to be inhabited.* How could it be inhabitable but for the sending of the early and the latter rain? How can the rain be sent except by the winds? and how can the fickle winds do their errands unless they have a guide? Suppose a new piece of human mechanism were shown to one of us, and we were told the object of it was to measure time; now, if we should seek to examine it with the view to understand its construction, would we not set out upon the principle—the theory—that it was made to measure time? By proceeding on any other supposition or theory we should be infallibly led into error. And so it is with the physical machinery of the world. The theory upon which this work is conducted is that *the earth was made for man;* and I submit that no part of the machinery by which it is maintained in a condition fit for him is left to chance, any more than the bit of mechanism by which man measures time is left to go by chance.

The question, How can two currents of air cross? answered.

356. Notwithstanding the amount of circumstantial evidence that has already been brought to show that the air which the north-east and the south-east trade-winds discharge into the belts of equatorial calms, does, in ascending, cross—that from the southern passing over into the northern, and that from the northern passing over into the southern hemisphere (see diagram)—yet some have implied doubt by asking the question, "How are two such currents of air to pass each other?" And, for the want of light upon this point, the correctness of my reasoning, facts, inferences, and deductions have been questioned. In the first place, it may be said in reply, the belt of equatorial calms is often several hundred miles across, seldom less than sixty; whereas the depth of the volume of air that the trade-winds pour into it is only about three miles, for that is supposed to be about the height to which the trade-winds extend. Thus we have the air passing into these calms by an opening on the north side for the north-east trades, and another on the south for the south-east trades, having a cross section of three miles vertically to each opening. It then escapes by an opening upward, the cross section of which is sixty or one hundred, or even three hundred miles. A very slow motion upward there will carry off the air in that direction as fast as the two systems of trade-winds, with their motion of twenty miles an hour, can pour it in; and that *curds* or *flakes* of air can readily cross each other and pass in different directions without interfering the one with the other, or at least without interfering to that degree which prevents, we all know. The brown fields in summer afford evidence in a striking manner of the fact that, in nature, flakes, or streamlets, or curdles of air do really move among each other without obstruction. That tremulous motion which we so often observe above stubble-fields, barren wastes, or above any heated surface, is caused by the ascent and descent, at one and the same time, of flakes of air at different temperatures, the cool coming down, the warm going up. They do not readily commingle, for the astronomer long after nightfall, when he turns his telescope upon the heavens, perceives and laments the unsteadiness they produce in the sky. If the air brought

to the calm belt by the north-east trade-winds differ in temperature (and why not?) from that brought by the south-east trades we have the authority of Nature for saying that the two currents would not readily commingle (§ 98). Proof is daily afforded that they would not, and there is reason to believe that the air of each current, in streaks, or patches, or *flakes*, does thread its way through the air of the other without difficulty. Therefore we may assume it as a postulate which Nature concedes, that there is no physical difficulty as to the two currents of air, which come into those calm belts from different directions, crossing over, each in its proper direction, without mingling.

Subjects which at sea present themselves for contemplation.

516. One need not go to sea to perceive the grand work which the clouds perform in collecting moisture from the crystal vaults of the sky, in sprinkling it upon the fields, and making the hills glad with showers of rain. Winter and summer, "the clouds drop fatness upon the earth." This part of their office is obvious to all, and I do not propose to consider it now. But the sailor at sea observes phenomena and witnesses operations in the terrestrial economy which tell him that, in the beautiful and exquisite adjustments of the grand machinery of the atmosphere, the clouds have other important offices to perform besides those merely of dispensing showers, of producing the rains, and of weaving mantles of snow for the protection of our fields in winter. As important as are these offices, the philosophical mariner, as he changes his sky, is reminded that the clouds have commandments to fulfil, which, though less obvious, are not therefore the less benign in their influences, or the less worthy of his notice. He beholds them at work in moderating the extremes of heat and cold, and in mitigating climates. At one time they spread themselves out; they cover the earth as with a mantle; they prevent radiation from its crust, and keep it warm. At another time they interpose between it and the sun; they screen it from his scorching rays, and protect the tender plants from his heat, the land from the drought; or, like a garment, they overshadow the sea, defending its waters from the intense forces of evaporation. Having performed these offices for one place, they are evaporated and given up to the sunbeam and the winds again, to be borne on their wings away to other places which stand in need of like offices. Familiar with clouds and sunshine, the storm and the calm, and all the phenomena which find expression in the physical geography of the sea, the right-minded mariner, as he contemplates "the cloud without rain," ceases to regard it as an empty thing; he perceives that it performs many important offices; he regards it as a great moderator of heat and cold—as a "compensation" in the atmospherical mechanism which makes the performance perfect. Marvellous are the offices and wonderful is the constitution of the atmosphere. Indeed, I know of no subject more fit for profitable thought on the part of the truth-loving, knowledge-seeking student, be he seaman or landsman, than that afforded by the atmosphere and its offices. *Of all parts of the physical machinery, of all the contrivances in the mechanism of the universe, the atmosphere, with its offices and its adaptations, appears to me to be the most wonderful, sublime, and beautiful.* In its construction, the grandeur of knowledge is displayed. The perfect man of Uz, in a moment of inspiration, thus bursts forth in laudation of this part of God's handiwork, demanding of his comforters, "But where shall wisdom be found, and where is the place of understanding? The depth saith, It is not in me; and the sea saith, It is not with me. It cannot be gotten for gold, neither shall silver be weighed for the price thereof. No mention shall be made of coral or of pearls, for the price of wisdom is above rubies. Whence, then, cometh wisdom, and where is the place of understanding? Destruction and Death say, We have heard the fame thereof with our ears. God understandeth the way thereof, and He knoweth the place thereof; for He looketh to the ends of the earth, and seeth under the whole heaven; *to make the weight for the winds;* and He weigheth the waters by measure. When He made a decree for the rain, and a way for the lightning of the thunder, then did He see it and declare it; He prepared it, yea, and searched it out."* When the pump-maker came to ask Galileo to explain how it was that his pump would not lift water higher than thirty-two feet, the philosopher thought, but was afraid to say, it was owing to "the weight of the winds;" and though the fact that the air has weight is here so distinctly announced, philosophers never recognised the fact until within comparatively a recent period, and then it was proclaimed by them as a great discovery. Nevertheless, the fact was set forth as distinctly in the Book of Nature as it is in the Book of Revelation; for the infant, in availing itself of atmospherical pressure to draw milk from its mother's breast, unconsciously proclaimed it.

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* Job xxviii.

## THE SUBSTANCE OF THINGS HOPED FOR,—THE EVIDENCE OF THINGS NOT SEEN.

WE HAVE NOT YET EXHAUSTED THE THOUGHTS AND IDEAS SUGGESTED TO US BY THE ATMOSPHERE; BUT, AS THE ORIGIN OF THOSE ABOUT TO ENGAGE OUR ATTENTION PROCEEDS FROM A DIFFERENT SOURCE, WE MAKE A DIVISION, NOT UNMINDFUL OF THE ARRANGEMENT OBSERVED IN THE MUSEUM OF THE VATICAN, WHERE RAPHAEL'S TRANSFIGURATION IS PLACED IN A SMALL ROOM, AND NOT AT THE END OF A LONG GALLERY, TO KEEP THE MIND UNDISTRACTED FROM THIS TRIUMPH OF ART.

THE CHIEF EVENTS, THEN, IN THE SACRED RECORD THAT ARE MORE ESPECIALLY CONNECTED WITH OUR SUBJECT, WILL BE BRIEFLY REFERRED TO IN THE FEW PAGES THAT FOLLOW, IN THE HUMBLE HOPE THAT NONE OF THE WORDS OF INSPIRATION, SO CAREFULLY WEIGHED, WILL BE HERE MISINTERPRETED.

AND ENOCH WALKED WITH GOD, AND HE WAS NOT: FOR GOD TOOK HIM.—*Genesis* v. 24.

BY FAITH ENOCH WAS TRANSLATED THAT HE SHOULD NOT SEE DEATH; AND WAS NOT FOUND, BECAUSE GOD HAD TRANSLATED HIM: FOR BEFORE HIS TRANSLATION HE HAD THIS TESTIMONY, THAT HE PLEASED GOD.—*Hebrews* xi. 5.

The gifted writer of the 'Protoplast' has included in the paper on the "First Translation," and in an outline for meditation on "The Ascension," much of what we learn from the Holy Scriptures on these subjects.

Suffice it, therefore, to take into consideration these things in order.

## ENOCH'S TRANSLATION.

He was not, for God took him: My own impression is, that he was *literally walking* with the Angel of the Covenant, just as Adam walked with Him in Eden: and that the ascending Son of God took him with Him as He left the earth. It may be so, but this we *know*, that without sickness, without decay, without a moment's pain, Enoch passed away to dwell "for ever with the Lord." Suddenly, and perhaps most unexpectedly, he was called to leave the sin-stained world, where his righteous soul had been vexed from day to day by the unlawful deeds of men, for another home, where sorrow cannot enter, and evil cannot stay. He did not see death. Even the shadow of its darkness fell not upon his pathway, his sun went not down; but the light of life brightened into the light of immortality. Yet, flesh and blood cannot inherit the kingdom of God. Enoch was *changed*. In a moment his corruption was taken away, and his sin was purged; his carnal body became a spiritual body; the forces of the material ceased to hold him prisoner; he was free to travel onward through the boundless universe of God. Think of him, for an instant, as taking his wondrous journey to the eternal throne, bodily carried through space (that space which to the philosophic mind is more astonishing than the worlds of glory which it parts and holds asunder), passing onward from one sun-star to another, drawing nearer and nearer to the tabernacle of God. No poetic fancy ever reached unto the sublimity of Scripture fact. Yet men, who will read with admiration the conceptions of Milton and Dante, see no beauty in the thought suggested by those few simple words of the Spirit, "Enoch was *translated*."

As Abel was the first to enter the heavenly Jerusalem, as a spirit freed from its mortal prison, Enoch was the first to dwell there in a glorified material form. Thus he becometh to us the pledge of Christ's power to raise us unto the like privilege, and a seal of the promise, "I will receive you unto myself." How vividly is brought before us the real existence of the Celestial City! Enoch, our *brother*, is already there: he has been received into its glory, and will leave it no more till the day of which he prophesied, when he shall come again with the ten thousand saints of God. Like Enoch, in his character and in his ministry, the latter-day saints will be like him also in their Translation. It shall be granted unto them to escape death. That thing which the foolish natural heart will ever shrink from, will not be one of their many trials. Passing *through* the dread tribulation of the last time, they will live on to receive their Master, and bid Him welcome to His earthly kingdom.

Suddenly will the glory of the advent break upon them. Long as they have expected Jesus, the hour of His coming will find them quietly engaged in the ordinary occupations and labours of life—in the field, in the market, in the exchange—mingling with the children of this world, and yet bearing, unseen, the angel's seal upon them.

With what glad surprise shall they lift their eyes to the heavens, and behold Him for whom they have waited, and watched, and prayed. Glory and beauty will be spread around Him, such as human thought has never pictured; angels will be gathered near Him in bright array; saints will follow Him, in forms of spiritual perfection; but upon *Him*, and Him alone, will the gaze of believers rest. All else will be forgotten in the consciousness that He whom they have so long loved *unseen* is before them; that the veil is taken away from the face of the Crucified, the Nazarene, the Man of sorrow and of grief; now the Triumphant, the Conqueror, the rejoicing Bridegroom,—the ineffable loveliness of *His* glorified humanity will arrest their regard: as they look upon Him, all

corruption, weakness, deformity, and mortality will pass away, and they will be transformed into the image of the heavenly Adam. Thus will they be prepared to follow Him in the regeneration whithersoever He goeth; and they shall never leave Him more! Millennial years may roll away; the millennial world may change; but neither the tremendous last conflagration, nor the end of time, will sever them from Jesus. Eternity will be spent with Him. In *His* company they will be *translated* to the true Jerusalem,—the incorruptible tabernacle of the Lord.

Perhaps there were few in Enoch's days who saw anything representative in his life, ministry, and departure from amongst them.

Years passed away, the world that *then* was, perished, and a new world arose; and God, in the abounding of His mercy towards the "slow of heart," and dull of understanding, gave a repetition of the Translation-type in Elijah, His servant.

There is something very beautiful in the condescension of our heavenly Teacher, who, knowing our infirmities, and our forgetfulness of truth, thus presents it again and again to the mind. Having said so much upon the features of Enoch's private life and public teaching, I will not dwell on those of Elijah, except to notice the striking similarity which exists between the two men who were thus selected to shadow forth the *changed* saints.

Elijah's character is not described by the Holy Ghost in a sentence, as was that of Enoch. We are left to gather it for ourselves from the incidents in his history; but how plainly we find the resemblance we might expect to be manifested! Elijah walked before the Lord in the abiding sense of his *reconciliation* to Him; he was the friend of his Divine Master; we read of his *intimate intercourse* and communion with Him. He seemed like a favoured child, to whom nothing was refused; so bold was he in the love which casteth out fear, that he asked and obtained some of the most signal interpositions of God on his behalf ever granted to Old Testament believers. "He prayed earnestly that it might not rain, and it rained not on the earth for the space of three years and six months." He prayed again, "and the heavens gave rain, and the earth brought forth fruit." For him, and at his word, God, for the first time (at least manifestly), raised the dead. For him, and in compliance with his request, God twice acknowledged the reality of his mission by sending down celestial fire.

Then how complete was Elijah's *separation from the world!* So great was his spirit solitude that it drew from him that cry of bitterness, "I, even I *only* am left." He was also remarkable for his steady *progress* in the ways of God. We read less of Elijah's backslidings than almost of any saint's departures from the right path. Except in the one instance of his impatience, when he sat under the juniper-tree, and begged to die, his conduct affords example rather than warning. That he sinned oft and grievously there is no doubt, for he was a man of like passions with ourselves; but we cannot read his history and not feel that day by day, and hour by hour, he gained in the race of life, pressing forward to the goal with ever increasing strength. His *dependance on God* is as strikingly manifested,—he was essentially a man of prayer. Not in human pride and human strength did he command the barrel of meal and cruse of oil to last; or the dead child to arise; or the heavenly fire to descend; but in the name of the Lord God of Israel. As a servant, he pleaded with Jehovah, while as a prophet he prevailed in the sight of men.

In all these several points of character we see that Elijah was made like unto Enoch, prefiguring (even as *he* did in earlier days) the elect of the last time. The same similarity exists in the public ministry of the two men. In Elijah we see the same stern, unflinching denunciation of God's judgment, the same holy appeal to the answer by fire; and although we do not read of the expressions made use of by him in declaring the Coming of the Lord, we know that he was the herald of that great event, for it is in allusion to this fact that the Spirit, foretelling the mission of that latter-day witness, who shall make straight the way of the Lord, chooses the mystic name of Elijah as his title. "Behold, I will send you Elijah the prophet, before the coming of the great and dreadful day of the Lord; and he shall turn the hearts of the fathers to the children, and the heart of the children to their fathers, lest I come and smite the earth with a curse."

Let us, therefore, look for a few moments at Elijah's Translation, for it is with this closing triumph for the persecuted believers of Earth's vintage days that we now have most to do.

We find the account in 2 Kings ii. 1. "It came to pass when the Lord would take up Elijah into heaven by a whirlwind," &c. I can imagine the scoffer's heart saying, "As if a whirlwind could lift a man from earth to heaven." Nay, but the power of God, who made the worlds, could carry Elijah to the "far-off" land. The whirlwind was the thing which Elisha saw, it was to the ascending prophet just what the cloud, which received Jesus out of the sight of the disciples at Bethany, was to the departing Saviour. Yet, mark the beauty of the type. The whirlwind immediately preceded the call of Elijah to the throne of God; it was the *sign*, and the *accompaniment* of that glorious change, for which he had been taught to look. When the storm arose around him, the man of God

knew that his redemption from the sin and sorrow of earth was near at hand, and that before it passed away his immortality would be begun.

Is not the same sign given to the saints of the latter-day? "When ye shall see these things come to pass, know ye that the kingdom of God is nigh." When that whirlwind ariseth, which shall sweep over the thrones and kingdoms of this world, making the whole earth waste and desolate, the sons of God may lift up their heads, and expect their promised glory; for before that storm is lulled, they shall have put on the translation-form, and the eternal beauty.

I would notice another circumstance in Elijah's removal from this world, "The chariot of fire and horses of fire." These have generally been considered a convoy of angels; and the expression in Psalm lxviii. 17, has been quoted in illustration of this view. I do not, however, accept this interpretation, and rather think that this appearance was designed of God to prefigure that fiery baptism which is to accompany the day of the Lord, through which the changed saints shall pass unhurt.

As the fire injured not the transformed spiritualized body of the ascending prophet, so the brimstone-rain of the day of Christ will have no power over the ransomed of the Lord. In the midst of it shall they walk with the Form of the Son of God; and their enemies will acknowledge concerning them, "Not an hair of their head was singed, neither were their garments changed, and the smell of fire passed not on them."

One word more. Elijah was taken up into *heaven*. If, then, a momentary doubt could ever have entered the mind as to the locality of the translated Enoch, this express declaration altogether removes it. And let this be the everlasting answer to the saying of some, that the redeemed are to pass eternity upon this earth in a renovated condition.

In *heaven* Christ hath prepared our places for us, and to the very innermost sanctuary of our God shall the translated saints have entrance.

Yet *once* again after Elijah's glorification did Jehovah present to man, in *visible* manifestation, that great truth which peculiarly comes before us for consideration in this Paper,—the *Transformation* of those Saints whose privilege it will be to escape death.

I must ask my readers now to carry forward their thoughts to the days of the Son of Man, and to the vision of the "holy mount."

In the hour of Christ's Transfiguration, He showed Himself as the pattern of the Translation-Saints, just as in the hour of His return from the grave, He showed Himself as the pattern of the Resurrection-Saints. It is important at all times to mark the *connexion of events* in the life of Jesus; and it is especially necessary to notice under what circumstances this peculiar revelation of His glory was made. In the ninth of Luke (verses 18-28) we read of a conversation held between Jesus and His followers respecting His death at Jerusalem. We who have never known Christ after the *flesh*, cannot imagine the anguish with which the conviction smote upon the hearts of those who loved Him, that they were so soon to lose Him, by a death of pain and shame. So hateful was the idea to Peter, that, as another Evangelist tells us, he tried to turn his Master from His appointed path, drawing forth that severe rebuke, "Get thee behind me, Satan," &c.

Even although the Lord spoke in the same discourse of His resurrection from the dead, and the glory of His *Second* Advent, all was lost upon the sorrowing disciples, and the one thing present to their imagination was the inevitable suffering of their precious friend. Partly in compassion to the intensity of their grief, partly that they might be the better witnesses to us of millennial truths, Christ selected three of His servants, to behold by anticipation the future glory of the day of God. It is written in the 28th verse of the same chapter—"And it came to pass about an eight days after these sayings, He took Peter, and John, and James, and went up into a mountain to pray, and as He prayed, the fashion of His countenance was altered, and His raiment was white and glistening. And, behold, there talked with Him two men, which were Moses and Elias, who appeared in glory, and spake of His decease, which He should accomplish at Jerusalem."

Think, now, what great truths were brought before the disciples in this heavenly vision.

1st. It set forth the nature of that mighty change which must pass upon flesh and blood, before it can inherit the kingdom of God.

Although it was the incorruptible body of Christ which was before them, yet it changed as they gazed upon it; the marred visage, and bowed form of sorrow, were transfigured, and wore another likeness. Matthew describes the appearance of glory by the expression—"His face did shine as the sun;" using almost the same words in which John depicts His beauty as seen in the Apocalyptic vision. (Rev. i. 16.) As it was with Jesus, it shall be with His people; the fashion of their countenances shall alter in the day of their redemption, assuming immortality and beauty never seen in this present state, and their old-world garments shall become the white raiment which is to endure for ever.

2ndly. The vision showed them the certainty of Christ's future glorification. He who had proclaimed to them His approaching degradation, and rejection of men, was for one brief moment shown to them, in the Form which He should hereafter wear, as King of kings and Lord of lords. They saw Him declared to be the Son of God; they were eye-witnesses of His majesty; the voice of His Heavenly Father proclaimed Him as the Messiah, and attested His mission to the world.

3rdly. This vision taught the Resurrection of the Dead, and the Transfiguration of the Living, in their *immediate connexion* with the revelation of Christ in glory. Moses appeared as the Representative of those who, though they be "dead, yet shall live;" and Elias as the Representative of those who, living and believing in Christ, "shall *never* die." The one Saint was an earnest of the resurrection; the other an earnest of the transformation. Both were revealed in one *common* glory, standing side by side with Him, who is the Lord of the Dead, and the Living, the Eternal Head of the Risen and the Changed.

Thus did Jesus bring suddenly before them the events of that latter day, when He shall stand upon the earth, between two companies of the redeemed, those who have *overcome* death, and those who have *escaped* death through their union with Himself, the heavenly Adam; whose glorious image they shall both wear henceforth for ever.

Now, observe how this remarkable revelation of things to come met the doubts, and sorrows, and perplexities of the disciples. Christ had spoken of His future glory, and they had not understood His words. Therefore "He was *transfigured* before them." He had told them of the resurrection from the dead, and they had marvelled. Therefore Moses, the resurrection-type, stood before them. He had referred to those who shall be found on earth at His second coming, and they had doubted of His meaning. Therefore Elias, the translated Prophet, also appeared as the transfiguration-type. Remember, also, how it is said—These two men spake with Jesus of His decease, which He should accomplish at Jerusalem, that very event to which they had looked forward with such agonized feeling. Think you not that, as they listened to that celestial converse, they learnt the *necessity* of their Master's suffering, and knew that, were He to turn from His love-work, neither dead Saints could rise, nor living Saints be *changed*, nor He himself, the Covenant Head of both, be glorified? The vision passed; the disciples found themselves alone with Jesus; He was again to them the man of sorrows, the Son of Mary; and they descended the mountain with Him, to mingle again with the crowd from which they had been withdrawn. It is evident, however, that they pondered over what they had seen; and it is very remarkable that Matthew relates a conversation which took place between them and their Lord, just *after* the vision, and in reference to it:—"Jesus charged them, saying, Tell the vision to no man, until the Son of man be risen again from the dead. And His disciples asked Him, saying, *Why* then say the scribes that Elias must first come?" They seem to have connected Elijah's appearance on the mount with the prophecy of Malachi, without possessing any clear and definite ideas on the subject. Mark well Christ's answer—"Elias truly *shall* first come, and restore all things. But I say unto you, that Elias *is* come already, and they knew him not, but have done unto him whatsoever they listed." In these words Jesus explains the nature of the Elijah-type, and teaches the disciples not to look for the *actual presence* of the translated prophet. As John the Baptist, coming in the spirit and power of Elias, preceded His first advent, so in like manner another shall arise at the time of the end, bearing the prophetic name, and he, with his brethren, men of Elijah's character and Elijah's ministry, shall prove the heralds of the second advent.

As years rolled on, the truths taught to Peter, James, and John, in the hour of Apocalypse, spent with Jesus on the mount, became better understood; and when the New Testament Church arose, all the Apostles with one voice proclaimed them boldly, clearly, in demonstration of the Spirit and in power.

Let us turn, in conclusion, to the writings of St. Paul, and see how beautifully he touches upon the theme of our consideration. Look first to 1 Cor. xv. 51—"We shall not all sleep, but we shall all be *changed*, in a moment, in the twinkling of an eye, at the last trump." Think of that mysterious change, so instantaneous, so entire, so abiding; a change from sorrow to joy, from pain to perfection, from weakness to strength, from deformity to beauty, from corruption to immortality; a change which will fit us to dwell for ever with the Son of God. Now, look at 1 Thess. iv. 15, 16—"We which are alive, and remain unto the coming of the Lord, shall not prevent them which are asleep. For the Lord himself shall descend from heaven with a shout, with the voice of the Archangel, and with the trump of God: and the dead in Christ shall rise first: then we which are alive and remain shall be caught up together with them in the clouds, to meet the Lord in the air, and so shall we ever be with the Lord."

How beautiful is the thought, that the last act of Christ's Militant Church on earth will be to *wait* for their brethren. Even although they long to gather around their approaching Saviour, they will pause at the threshold of their happiness, and tarry for the perfection of the beloved sleepers in the dust of earth. Then shall the risen and the changed ascend together to meet Him from whom all their future blessedness shall be derived. Then shall the Hosanna of the redeemed burst forth as one mighty sound from unnumbered voices—"Salvation to our God which sitteth upon the throne, and unto the Lamb."

One final word. I know that of late years a strong desire has been felt by many Christians to *outlive* the storm which is so plainly gathering over us; and to be among the generations of those who shall see the second appearing of the Lord's Christ. Perhaps this may be the case with some readers of this Paper, their daily prayer is that God would count them worthy to receive their Master, as His friends upon the earth; to hail His approach as those who have watched, and waited, for His coming. I would say to such—Know ye what ye ask? Have you considered well that tremendous tribulation which lies between you and the glory upon which your thoughts are dwelling? Are you *able* to drink the last cup of bitterness, and to be baptized with the last baptism of suffering? If, in the confidence of faith, you answer, "We are able," then let me entreat you to study well the Enoch-type. Seek to be conformed unto the first translated saint, in your life and in your ministry. Endeavour to *walk with God*, as he did, leaning your whole weight upon Almighty strength. If for a moment you quit your hold of One who can alone sustain the soul in the "hour of temptation," your feet will stumble. Strive, in the words of the dying Dr. Gordon, to "make a *companion* of God." Seek Him in trivial things, for He numbereth the grains of sand upon the sea-shore; seek Him in great things, for by Him suns, and comets, and planets subsist in their glory; seek Him in gladness, for He sanctifieth; seek Him in sorrow, for He comforteth; seek Him in disease, for He healeth; seek Him in sin, for He pardoneth; seek Him in *every* state, and under *all* circumstances, for He loveth you at all times.

Let your mission resemble that of Enoch. Think of the responsibility of God's last witnesses in a fallen world. You will have to bear your part in a mightier struggle than has ever yet been known between God's army and Satan's. In a peculiar manner, *you* will have to wrestle against principalities, against powers, against the rulers of the darkness of this world, against spiritual wickedness in high things. Take unto you, then, the whole armour of God, that ye may be able to withstand in the evil day, and having done all to stand. Fear not to prophesy that Christ cometh quickly, while the world proclaims "There is no God." Fear not to stand by the altars of Baal, and appeal to the fiery answer of the day of the Lord. Fear not to tell of the judgment, and fiery indignation, which shall devour the adversaries. When the thrones of earth are swept away, and the kingdoms of men crumble into dust, look up to heaven, and see Jesus at the right hand of God. To Him whose *right* it is, shall the dominion be shortly given. Possess your souls in *patience*. *Watch*, but *wait*. Remember always, that if you live, you "live unto the Lord," and if you die, you "die unto the Lord;" living or dying, therefore, you are the Lord's. Neither "*death*" nor "*life*" can separate you from Jesus. He died for you, that whether you *wake* or *sleep*, you should live together with Him.

# THE ASCENSION

I ASCEND UNTO MY FATHER, AND YOUR FATHER; AND TO MY GOD, AND YOUR GOD.—*St. John* xx. 17.

. . . AND HE LIFTED UP HIS HANDS, AND BLESSED THEM. AND IT CAME TO PASS, WHILE HE BLESSED THEM, HE WAS PARTED FROM THEM, AND CARRIED UP INTO HEAVEN. AND THEY WORSHIPPED HIM.—*St. Luke* xxiv. 50-52.

YE MEN OF GALILEE, WHY STAND YE GAZING UP INTO HEAVEN? THIS SAME JESUS, WHICH IS TAKEN UP FROM YOU INTO HEAVEN, SHALL SO COME IN LIKE MANNER AS YE HAVE SEEN HIM GO INTO HEAVEN.—*Acts* i. 11.

## I. THE MANNER OF THE ASCENSION.

1. *Suddenly.*
   When in converse with His followers; they not thinking of His leaving them.
2. *Privately.*
   Not before the World, but before a few believers representing the true Church.
3. *Miraculously.*
   Contrary to the existing laws of gravity, &c. An earnest of the time when the resurrection bodies of the Saints shall be able thus to move from place to place independently of physical laws.

## II. THE OBJECT OF THE ASCENSION.

1. *To enter into His Glory.*
   The exaltation and triumph are contrasted with the previous humiliation.
2. *To live in the Holy Place as the visible witness of the success of His Mission.*
   All the intelligent Angelic Universe behold Him as the justified and accepted Mediator. The spirits of just men see in Him the Redeemer whose accomplished work has saved them. God the Father having admitted them to Heaven *on trust*, knowing that Christ would be their Saviour, the *ascension* sealed and confirmed their right to glory.
3. *To take His place as the Forerunner of His New Testament Church.*
   We sit with Him in Heavenly places.
4. *To commence His intercessory work.*
   His presence in heaven is the signal for the casting down of Satan as the accuser of the Brethren.

## PRACTICAL INFERENCES.

1. The promise of the return: "This same Jesus shall so come in like manner."
2. The Holiness of the Expectant Church a necessity: "Seeing ye look for such things," &c. Notice: "The Lord's last act was *blessing*. *While* He blessed them," &c.
   The High Priest's attitude on returning from the Holy Place—arms outstretched in blessing. *He comes to Bless.*
3. The Disciples saw in the Ascension a sign of Divinity,—"*they worshipped Him.*"

   FOR THIS WE SAY UNTO YOU BY THE WORD OF THE LORD, THAT WE WHICH ARE ALIVE, AND REMAIN UNTO THE COMING OF THE LORD, SHALL NOT PREVENT THEM WHICH ARE ASLEEP. FOR THE LORD HIMSELF SHALL DESCEND FROM HEAVEN WITH A SHOUT, WITH THE VOICE OF THE ARCHANGEL, AND WITH THE TRUMP OF GOD; AND THE DEAD IN CHRIST SHALL RISE FIRST: THEN WE WHICH ARE ALIVE AND REMAIN, SHALL BE CAUGHT UP TOGETHER WITH THEM IN THE CLOUDS, TO MEET THE LORD IN THE AIR; AND SO SHALL WE EVER BE WITH THE LORD.

   WHEREFORE COMFORT ONE ANOTHER WITH THESE WORDS.—1 *Thess.* iv. 15-18.

## "THOUGHTS ANALYTICALLY ARRANGED."

I here desire to acknowledge the assistance I have derived from a carefully compiled and analytically arranged work, by Henry Southgate, entitled 'Many Thoughts of Many Minds.' From this valuable store I select as a specimen, for those who are still unacquainted with the work, the four following topics of great general interest, to which I add a few extracts from other authors, likewise connected with these subjects.*

These topics are The Bible, God, Christ, and Christianity.

As an introduction I give Barton's poem entitled

### A POET'S NOBLEST THEME.

THE works of man may yield delight,
And justly merit praise;
But though awhile they charm the sight,
That charm in time decays.
The sculptor's, painter's, poet's skill,—
The art of mind's creative will,
In various modes may teem;
But none of these, however rare
Or exquisite, can truth declare
A poet's noblest theme.

The sun, uprising, may display
His glory to the eye,
And hold in majesty his way
Across the vaulted sky;
Then sink resplendent in the west,
Where parting clouds his rays invest
With beauty's softest beam;
Yet not unto the sun belong
The charms which consecrate in song
A poet's noblest theme.

The moon, with yet more touching grace,
The silent night may cheer,
And shed o'er many a lonely place
A charm to feeling dear;
The countless stars which grace her reign,
A voiceless, but a lovely train,
With brilliant light may gleam;
But she nor they, though fair to see,
And formed for love, can never be
A poet's noblest theme.

The winds, whose music to the ear
With that of art may vie—
Now loud, awakening awe and fear,
Then soft as pity's sigh;—
The mighty ocean's ample breast,
Calm or convulsed, in wrath or rest,
A glorious sight may seem:
But neither winds nor boundless sea,
Though beautiful or grand, can be
A poet's noblest theme.

The earth, our own dear native earth!
Has charms all hearts may own;
They cling around us from our birth,—
More loved as longer known;
Hers are the lovely vales, the wild
And countless forests, mountains piled
On high, and many a stream
Whose beauteous banks the heart may love,
Yet none of these can truth approve
A poet's noblest theme.

The virtues, which our fallen estate
With foolish pride would claim,
May, in themselves, be good and great,—
To us an empty name.
Truth, justice, mercy, patience, love,
May seem with man on earth to rove,
And yet may *only seem*;
To none of these, *as man's*, dare I
The title of my verse apply—
"A poet's noblest theme."

To GOD alone, whose power divine
Created all that live;
To GOD alone, can truth assign
This proud prerogative:—
But how shall man attempt HIS praise,
Or dare to sing in mortal lays
OMNIPOTENCE SUPREME!
When seraph-choirs, in heaven above,
Proclaim His glory and His love,
Their noblest, sweetest theme?

Thanks be to God! His grace has shown
How sinful man on earth
May join the songs which round His throne
Give endless praises birth:
HE gave HIS SON for man to die!
HE sent HIS SPIRIT from on High!
To consummate the scheme:
Oh! be that consummation blest!
And let REDEMPTION be confest
A poet's noblest theme.

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* The extracts I have made are marked *.

## THE BIBLE.

They had the Bible. Hast thou ever heard
Of such a Book? the author, God himself;
The subject, God and man, salvation, life
And death—eternal life, eternal death—
Dread words! whose meaning has no end, no bounds!
Most wondrous Book! bright candle of the Lord!
Star of eternity! the only star
By which the bark of man could navigate
The sea of life, and gain the coast of bliss
Secure; th' only only star which rose on Time,
And, on its dark and troubled billows, still,
As generation, drifting swiftly by,
Succeeded generation, threw a ray
Of heaven's own light, and to the hills of God,
The eternal hills, pointed the sinner's eye.
By prophets, seers, and priests, and sacred bards,
Evangelists, apostles, men inspired,
And by the Holy Ghost anointed, set
Apart, and consecrated to declare
To Earth the counsels of the Eternal One—
This Book, this holiest, this sublimest Book,
Was sent. Heaven's will, Heaven's code of laws entire
To man, this Book contained; defined the bounds
Of vice and virtue, and of life and death;
And what was shadow, what was substance taught.
Much it revealed; important all; the least
Worth more than what else seemed of highest worth.
But this of plainest, most essential truth:
That God is one, eternal, holy, just,
Omnipotent, omniscient, infinite;
Most wise, most good, most merciful and true;
In all perfection most unchangeable:
That man, that every man of every clime.
And hue, of every age and every rank,
Was bad, by nature and by practice bad;
In understanding blind, in will perverse,
In heart corrupt; in every thought, and word,
Imagination, passion and desire,
Most utterly depraved throughout, and ill,
In sight of Heaven, though less in sight of man;
At enmity with God his Maker born,
And by his very life an heir of death:
That man, that every man was, farther, most
Unable to redeem himself, or pay
One mite of his vast debt to God; nay, more
Was most reluctant and averse to be
Redeemed, and sin's most voluntary slave:
That Jesus, Son of God, of Mary born
In Bethlehem, and by Pilate crucified
On Calvary, for man thus fallen and lost,
Died; and, by death, life and salvation bought,
And perfect righteousness, for all who should
In His great name believe: That He, the third
In the eternal Essence, to the prayer
Sincere should come, should come as soon as asked,
Proceeding from the Father and the Son,
To give faith and repentance, such as God
Accepts; to open the intellectual eyes,
Blinded by sin; to bend the stubborn will,
Perversely to the side of wrong inclined,
To God and his commandments just and good;
The wild rebellious passions to subdue,
And bring them back to harmony with heaven:
To purify the conscience, and to lead
The mind into all truth, and to adorn
With every holy ornament of grace,
And sanctify the whole renewed soul,
Which henceforth might no more fall totally,
But persevere, though erring oft, amidst
The mists of Time, in piety to God,
And sacred works of charity to men:
That he who thus believed, and practised thus,
Should have his sins forgiven, however vile;
Should be sustained at mid-day, morn, and even:
By God's omnipotent, eternal grace:
And in the evil hour of sore disease,
Temptation, persecution, war, and death—
For temporal death, although unstinged, remained—
Beneath the shadow of the Almighty's wings
Should sit unhurt, and at the Judgment Day
Should share the resurrection of the just,
And reign with Christ in bliss for evermore:
That all, however named, however great,
Who would not thus believe, nor practise thus,
But in their sins impenitent remained,
Should in perpetual fear and terror live;
Should die unpardoned, unredeemed, unsaved;
And at the hour of doom, should be cast out
To utter darkness in the night of hell,
By mercy and by God abandoned, there
To reap the harvest of eternal woe.

This did that Book declare in obvious phrase,
In most sincere and honest words, by God
Himself selected and arranged, so clear,
So plain, so perfectly distinct, that none
Who read with humble wish to understand,
And asked the Spirit, given to all who asked,
Could miss their meaning, blazed in heavenly light.

This Book, this holy Book, on every line
Marked with the seal of high divinity,
On every leaf bedewed with drops of love
Divine, and with the eternal heraldry
And signature of God Almighty stamped
From first to last,—this ray of sacred light,
This lamp, from off the everlasting throne,
Mercy took down, and in the night of Time
Stood, casting on the dark her gracious bow;
And evermore beseeching men with tears
And earnest sighs, to read, believe, and live.
And many to her voice gave ear, and read,
Believed, obeyed; and now, as the Amen,
True, Faithful Witness swore, with snowy robes
And branchy palms surround the fount of life,
And drink the streams of immortality,
For ever happy, and for ever young.

Many believed; but more the truth of God
Turned to a lie, deceiving and deceived:
Each with the accursed sorcery of sin,
To his own wish and vile propensity
Transforming still the meaning of the text.

Hear, while I briefly tell what mortals proved,
By effort vast of ingenuity,
Most wondrous, though perverse and damnable,
Proved from the Bible, which, as thou hast heard,
So plainly spoke that all could understand.
First, and not least in number, argued some
From out this Book itself, it was a lie,
A fable, framed by crafty men to cheat
The simple herd, and make them bow the knee
To kings and priests. These in their wisdom left
The light revealed, and turned to fancies wild;
Maintaining loud, that ruined, helpless man
Needed no Saviour. Others proved that men
Might live and die in sin, and yet be saved,
For so it was decreed; binding the will,
By God left free, to unconditional,
Unreasonable fate. Others believed
That he who was most criminal, debased,
Condemned, and dead, unaided might ascend
The heights of virtue; to a perfect law
Giving a lame, halfway obedience, which
By useless effort only served to show
The impotence of him who vainly strove
With finite arm to measure infinite;
Most useless effort, when to justify
In sight of God it meant, as proof of faith
Most acceptable, and worthy of all praise.
Another held, and from the Bible held,
He was infallible, most fallen by such
Pretence; that none the Scriptures, open to all,
And most to humble-hearted, ought to read
But priests; that all who ventured to disclaim
His forged authority, incurred the wrath
Of Heaven; and he who, in the blood of such,
Though father, mother, daughter, wife, or son,
Imbrued his hands, did most religious work,
Well pleasing to the heart of the Most High.
Others in outward rite devotion placed;
In meats, and drinks, in robe of certain shape,
In bodily abasements, bended knees;
Days, numbers, places, vestments, words and names;
Absurdly in their hearts imagining
That God, like men, was pleased with outward show.
Another, stranger and more wicked still,
With dark and dolorous labour, ill applied,
With many a gripe of conscience, and with most
Unhealthy and abortive reasoning,
That brought his sanity to serious doubt,
Mong wise and honest men, maintained that He,
First Wisdom, Great Messiah, Prince of Peace,
The Second of the uncreated Three,
Was nought but man, of earthly origin:
Thus making void the sacrifice divine,
And leaving guilty men God's holy law
Still unatoned, to work them endless death.

These are a part; but to relate thee all
The monstrous, unbaptised fantasies,
Imagination fearfully absurd,
Hobgoblin rites, and moonstruck reveries,
Distracted creeds, and visionary dreams,
More bodiless and hideously misshapen
Than ever fancy, at the noon of night,
Playing at will, framed in the madman's brain,
That from the Book of simple truth were proved—
Were proved, as foolish men were wont to prove,
Would bring my word in doubt, and thy belief
Stagger, though here I sit and sing, within
The pale of truth, where falsehood never came.

The rest, who lost the heavenly light revealed,
Not wishing to retain God in their minds,
In darkness wandered on.

*Pollok.*

*** BIBLE—the Attributes of the.**

THE LAW OF THE LORD IS PERFECT—CONVERTING THE SOUL;
THE TESTIMONY OF THE LORD IS SURE—MAKING WISE THE SIMPLE.
THE STATUTES OF THE LORD ARE RIGHT—REJOICING THE HEART;
THE COMMANDMENT OF THE LORD IS PURE—ENLIGHTENING THE EYES.
THE FEAR OF THE LORD IS CLEAN—ENDURING FOR EVER;
THE JUDGMENTS OF THE LORD ARE TRUE, AND RIGHTEOUS ALTOGETHER.
MORE TO BE DESIRED ARE THEY THAN GOLD, YEA, THAN MUCH FINE GOLD; SWEETER ALSO THAN HONEY AND THE HONEY-COMB. MOREOVER BY THEM IS THY SERVANT WARNED: AND IN KEEPING OF THEM THERE IS GREAT REWARD.

*David.*

FOR AS THE RAIN COMETH DOWN, AND THE SNOW FROM HEAVEN, AND RETURNETH NOT THITHER, BUT WATERETH THE EARTH, AND MAKETH IT TO BRING FORTH AND BUD, THAT IT MAY GIVE SEED TO THE SOWER AND BREAD TO THE EATER: SO SHALL MY WORD BE THAT GOETH FORTH OUT OF MY MOUTH: IT SHALL NOT RETURN UNTO ME VOID, BUT IT SHALL ACCOMPLISH THAT WHICH I PLEASE, AND IT SHALL PROSPER IN THE THING WHERETO I SENT IT. *Isaiah.*

FROM A CHILD THOU HAST KNOWN THE HOLY SCRIPTURES, WHICH ARE ABLE TO MAKE THEE WISE UNTO SALVATION, THROUGH FAITH WHICH IS IN CHRIST JESUS.

ALL SCRIPTRE IS GIVEN BY INSPIRATION OF GOD, AND IS PROFITABLE FOR DOCTRINE, FOR REPROOF, FOR CORRECTION, FOR INSTRUCTION IN RIGHTEOUSNESS; THAT THE MAN OF GOD MAY BE PERFECT, THOROUGHLY FURNISHED UNTO ALL GOOD WORKS. *St. Paul.*

THE WORD OF GOD IS QUICK AND POWERFUL, SHARPER THAN ANY TWO-EDGED SWORD, PIERCING EVEN TO THE DIVIDING

ASUNDER OF SOUL AND SPIRIT AND OF THE JOINTS AND MARROW, AND IS A DISCERNER OF THE THOUGHTS AND INTENTS OF THE HEART. *St. Paul.*

FOR ALL FLESH IS AS GRASS, AND ALL THE GLORY OF MAN AS THE FLOWER OF GRASS. THE GRASS WITHERETH, AND THE FLOWER THEREOF FALLETH AWAY; BUT THE WORD OF THE LORD ENDURETH FOR EVER. AND THIS IS THE WORD WHICH BY THE GOSPEL IS PREACHED UNTO YOU. *St. Peter.*

**BIBLE—Beauty of the.**

I use the Scriptures not as an arsenal to be resorted to only for arms and weapons, but as a matchless temple, where I delight to contemplate the beauty, the symmetry, and the magnificence of the structure, and to increase my awe and excite my devotion to the Deity there preached and adored. *Boyle.*

**BIBLE—Benefit derived from the.**

The sacred page
With calm attention scan! If on thy soul,
As thou dost read, a ray of purer light
Break in, O, check it not, give it full scope!
Admitted, it will break the clouds which long
Have dimmed thy sight, and lead thee, till at last,
Convictions, like the sun's meridian beams,
Illuminate thy mind.

*Samuel Hayes.*

**BIBLE—sometimes a Closed Book.**

Men, thus at variance with the truth,
Dream, though their eyes be open; reckless some
Of error; others well aware they err,
To whom more guilt and shame are justly due
Each the known track of sage philosophy
Deserts, and has a by-way of his own:
So much the restless eagerness to shine,
And love of singularity prevail.
Yet this, offensive as it is, *provokes*
*Heaven's anger less, than when the Book of God*
*Is forced to yield to man's authority,*
*Or from its straightness warp'd; no reck'ning made,*
*What blood the sowing of it in the world*
*Has cost; what favour for himself he wins,*
*Who meekly clings to it.* . . .
. . . . . .
Christ said not to his first conventicle,
Go forth and preach impostures to the world;
But gave them *Truth* to build on; and the sound
Was mighty on their lips; nor needed they,
Beside the Gospel, other spear or shield,
To aid them in their warfare for the faith.

*Dante.*

**BIBLE—the Christian's Bulwark.**

The Christian faith has been, and is still, very fiercely and obstinately attacked. How many efforts have been and are still made; how many books, serious and frivolous, able or silly, have been and are spread incessantly, in order to destroy it in men's minds! Where has this redoubtable struggle been supported with the greatest energy and success? and where has Christian faith been best defended? There where the reading of the Sacred Books is a general and assiduous part of public worship—there where it takes place in the interior of families and in solitary meditation. It is the Bible, the Bible itself, which combats and triumphs most efficaciously in the war between incredulity and belief. *Guizot.*

*** BIBLE—and the Common People.**

It was wonderful to see with what joy this book of God was received not only among the learneder sort, but generally all England over, among all the vulgar and common people; and with what greediness God's Word was read, and what resort to places where the reading of it was! Everybody that could, bought the book, or busily read it, or got others to read it to them, if they could not themselves. Divers more elderly people learned to read on purpose; and even little boys flocked, among the rest, to hear portions of the Holy Scripture read.

*Strype.*

**BIBLE—Divine Character of the.**

As a poem, moral and didactic, it is a repertory of divine instincts—a collection of the deepest intuitions of truth, beauty, justice, holiness—the past, the present, the future—which, by their far vision, the power by which they have stamped themselves on the belief and heart, the hopes and fears, the days and nights of humanity; their superiority to aught else in the thoughts or words of man, their consistency with themselves, their progressive and their close-drawn connection with those marvellous and unshaken facts, are proved divine in a sense altogether peculiar and alone. *Gilfillan.*

***. BIBLE—the best Expositor of the.**

I CEASE NOT TO GIVE THANKS FOR YOU, MAKING MENTION OF YOU IN MY PRAYERS; THAT THE GOD OF OUR LORD JESUS CHRIST, THE FATHER OF GLORY, MAY GIVE UNTO YOU THE SPIRIT OF WISDOM AND REVELATION IN THE KNOWLEDGE OF HIM: THE EYES OF YOUR UNDERSTANDING BEING ENLIGHTENED; THAT YE MAY KNOW WHAT IS THE HOPE OF HIS CALLING, AND WHAT THE RICHES OF THE GLORY OF HIS INHERITANCE IN THE SAINTS, AND WHAT IS THE EXCEEDING GREATNESS OF HIS POWER TO US-WARD WHO BELIEVE, ACCORDING TO THE WORKING OF HIS MIGHTY POWER, WHICH HE WROUGHT IN CHRIST, WHEN HE RAISED HIM FROM THE DEAD, AND SET [HIM] AT HIS OWN RIGHT HAND IN THE HEAVENLY [PLACES], FAR ABOVE ALL PRINCIPALITY, AND POWER, AND MIGHT, AND DOMINION, AND EVERY NAME THAT IS NAMED, NOT ONLY IN THIS WORLD, BUT ALSO IN THAT WHICH IS TO COME; AND HATH PUT ALL [THINGS] UNDER HIS FEET, AND GAVE HIM [TO BE] THE HEAD OVER ALL [THINGS] TO THE CHURCH, WHICH IN HIS BODY, THE FULNESS OF HIM THAT FILLETH ALL IN ALL.

*St. Paul, Ephesians* i. 16-23.

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It is most plain (writes Luther to his friend Spalatein) that we cannot attain to the understanding of Scripture, either by study, or by strength of intellect; therefore, your first duty must be to begin with prayer. Entreat the Lord to deign to grant you, in His rich mercy, rightly to understand His Word. There is no other interpreter of the Word of God but the Author of that Word Himself; even as He has said, 'They shall all be taught of God.' Hope nothing from your study or the strength of your intellect; but simply put your trust in God, and in the influence of His Spirit. *D'Aubigné's History of the Reformation*, vol. i. p. 320.

**BIBLE—Fulness of the.**

It has God for its author, salvation for its end, and truth, without any mixture of error, for its matter:—it is all pure, all sincere; nothing too much, nothing wanting. *Locke.*

**BIBLE—Glory of the.**

A glory gilds the sacred page,
Majestic like the sun;
It gives a light to every age;
It gives, but borrows none.

*Cowper.*

**BIBLE—Hope Begotten by the.**

The Bible is a precious storehouse, and the Magna Charta of a Christian. There he reads of his heavenly Father's love, and of his dying Saviour's legacies. There he sees a map of his travels through the wilderness, and a landscape, too, of Canaan. And when he climbs on Pisgah's top, and views the promised land, his heart begins to burn, delighted with the blessed prospect, and amazed at the rich and free salvation. But a mere professor, though a decent one, looks on the Bible as a dull book, and peruseth it with such indifference as you would read the title-deeds belonging to another man's estate. *Berridge.*

**BIBLE—Imperishableness of the.**

ALL FLESH IS GRASS, AND ALL THE GOODLINESS THEREOF IS AS THE FLOWER OF THE FIELD: THE GRASS WITHERETH, THE FLOWER FADETH: BECAUSE THE SPIRIT OF THE LORD BLOWETH UPON IT: SURELY THE PEOPLE IS GRASS. THE GRASS WITHERETH, THE FLOWER FADETH, BUT THE WORD OF OUR GOD SHALL STAND FOR EVER. *Isaiah.*

*** BIBLE—the Inditer of the.**

The Inditer of the Scriptures did know four things, which no man attains to know; which are, the mysteries of the kingdom of glory; the perfection of the laws of nature; the secrets of the heart of man; and the future succession of all ages. *Lord Bacon* (*Works*, i. 228).

*** BIBLE—and the Invention of Printing.**

. . . Printing, however, was the most *intellectual* of all the arts, and yet it will now be manifest that Infinite Wisdom was by no means in any haste to employ it. The orators of Greece and Rome had been allowed to try their skill once more in improving mankind.

The classics were permitted to enjoy their second, and more splendid triumph, and appeared before the world in a richer dress than they had ever done; and since the colloquial dialect, the tongue spoken by the people, was *not* the language of what was called the *Church*, in any nation of Europe, and Latin alone was her language everywhere, then let that tongue, through the press, also enjoy unprecedented scope. Let no Pontiff ever after have any reason to complain that ample justice was not first done to *his* system. Let *him* first have his

fill of *letters*, even to overflowing. Let him richly enjoy the first fruits, or the highest place, nay, the monopoly of all the arts, and even the printing-press to boot; and before the close of the fifteenth century, let there be issued from the press, above an hundred editions of the LATIN Bible, for such was the fact: and throughout Europe, let there be hourly spoken still, more than

"ten thousand words in an unknown tongue."

. . . . . We are imperatively bound to distinguish between the oratory of Greece and Rome, or the feeble language of literature, and the voice of Jehovah in His Word, when it once reached the ear or the eye of our forefathers, in their native tongue; to distinguish as carefully, between *the power of the press*, and the power of *what* issued from it; between printing, however splendid to the eye, and *what is* printed, when addressed by the Almighty to the heart; between all the wisdom of this world, and that which cometh down from above; between printed books without exception, and "the oracles of God." *Anderson (Introduction to the Annals of the English Bible).*

**BIBLE—Noble Composition of the Book of Job.**

*The Book of Job.*—I call that, apart from all theories about it, one of the grandest things ever written with pen. One feels, indeed, as if it were not Hebrew; such a noble universality, different from noble patriotism, or sectarianism, reigns in it. A noble book! all men's book! It is our first, oldest statement of the never-ending problem, man's destiny, and God's ways with him here in this earth. And all in such free flowing outlines; grand in its sincerity, in its simplicity, in its epic melody, and repose of reconcilement. There is the seeing eye, the mildly understanding heart. So *true* every way; true eyesight and vision for all things; material things no less than spiritual: the horse—"hast Thou clothed his neck with *thunder?*"—"he *laughs* at the shaking of the spear!" Such living likenesses were never since drawn. Sublime sorrow, sublime reconciliation; oldest choral melody as of the heart of mankind; so soft and great; as the summer midnight, as the world with its seas and stars! There is nothing written, I think, in the Bible or out of it, of equal literary merit. *Carlyle.*

**BIBLE—the Guide of Life.**

It is a belief in the Bible, the fruits of deep meditation, which has served me as the guide of my moral and literary life. I have found it a capital safely invested, and richly productive of interest. *Goethe.*

**BIBLE—Misapplication of the.**

Beware of misapplying Scripture. It is a thing easily done, but not so easily answered. I know not any one gap that hath let in more and more dangerous errors into the Church than this,—that men take the word of the sacred text, fitted to particular occasions, and to the condition of the times wherein they were written, and then apply them to themselves and others, as they find them, without due respect had to the differences that may be between those times and cases and the present. *Bishop Sanderson.*

**BIBLE—contains the Mystery of Mysteries.**

Within this awful volume lies
The mystery of mysteries:
Happiest they of human race,
To whom their God has given grace
To read, to fear, to hope, to pray,
To lift the latch, to force the way;
But better had they ne'er been born
Who read to doubt, or read to scorn.

*Sir Walter Scott.*

*** BIBLE—Opposition it had to encounter on being introduced into English.**

After reading the histories of Halle, Foxe, Stowe, Strype, Burnet, Collier, Turner, Lingard, and Soames, as well as the histories of the translations by Lewis, Herbert, and Dibdin, with the Biblical literature of Townley, Cotton, and Horne, still no one can possess any adequate or correct idea of that mighty phalanx of talent, policy, and power, so firmly arrayed against the introduction of divine truth in our native tongue into this kingdom; and consequently no reader has ever had before him the most powerful display, in comparatively modern times, of the irresistible energy of the Divine Word. *Christopher Anderson (Preface to the Annals of the English Bible).*

**BIBLE—Poetry of the.**

The Scripture affords us a divine pastoral drama in the Song of Solomon, consisting of two persons and a double chorus, as Origen rightly judges; and the Apocalypse of St. John is a majestic image of a high and stately tragedy, shutting and intermingling her solemn scenes and acts with a seven-fold chorus of hallelujahs and harping symphonies. And this my opinion, the grave authority of Pareus, commenting that book, is sufficient to confirm.

Or, if occasion shall lead, to imitate those magnific odes and hymns, wherein Pindarus and Callimachus are in most things worthy, some others in their frame judicious, in their matter most an end faulty. But those frequent songs, throughout the laws and prophets, beyond all these, not in their divine argument alone, but in the very critical art of composition, may be easily made appear over all the kinds of lyric poesy to be incomparable.

*Milton.*

**BIBLE—Poetry, Oratory, and Politics of the.**

There are no songs comparable to the songs of Zion; no orations equal to those of the Prophets; and no politics like those which the Scriptures teach. *Ibid.*

**BIBLE—Simplicity of the plan of Salvation.**

Oh! how unlike the complex works of man,
Heaven's easy, artless, unencumber'd plan;
No meretricious graces to beguile,
No clustering ornaments to clog the pile:
From ostentation as from weakness free;
It stands like the cerulean arch we see,
Majestic in its own simplicity,
Inscribed above the portal, from afar,
Conspicuous as the brightness of a star,
Legible only by the light they give,
Stand the soul-quickening words—Believe and live.

*Cowper.*

**BIBLE—Sublimity of the.**

There is not a book on earth so *favourable* to all the *kind*, and all the *sublime* affections, or so *unfriendly* to *hatred* and *persecution*—to *tyranny*, *injustice*, and *every* sort of *malevolence*, as the GOSPEL. It breathes nothing throughout but *mercy*, *benevolence*, and *peace*. . . . . Such of the doctrines of the gospel as are level to human capacity, appear to be agreeable to the purest truth and soundest morality. All the genius and learning of the heathen world, all the penetration of Pythagoras, Socrates, and Aristotle, had never been able to produce such a system of *moral duty*, and so *rational* an account of Providence and of man, as is to be found in the New Testament. *Beattie.*

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I have carefully and regularly perused these Holy Scriptures, and am of opinion that the volume, independently of its divine origin, contains more sublimity, purer morality, more important history, and finer strains of eloquence, than can be collected from all other books, in whatever language they may have been written. *Sir William Jones.*

**BIBLE—Teaching of the.**

The SCRIPTURES teach us the *best way of living*, the *noblest way of suffering*, and the *most comfortable way of dying*.

*Flavel.*

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Better teaching
The solid rules of civil government,
In their majestic, unaffected style,
Than all the oratory of Greece and Rome.
In them is plainest taught, and easiest learnt,
What makes a nation happy, and keeps it so;
What ruins kingdoms, and lays cities flat:
These only, with our law, best form a king.

*Milton.*

*** BIBLE—the Translator of the, to the People of God in England.**

*I have here translated, brethren and sisters, most dear and tenderly beloved in Christ, the New Testament, for your spiritual edifying, consolation and solace: Exhorting instantly, and beseeching those that are better seen in the tongues than I, and that have higher gifts of grace to interpret the sense of the Scripture, and meaning of the Spirit, than I, to consider and ponder my labour, and that with the spirit of meekness. And if they perceive in any places that I have not attained the very sense of the tongue, or meaning of the Scripture, or have not given the right English word, that they put to their hands to amend it, remembering that so is their duty to do. For we have not received the gifts of God for ourselves only, or for to hide them: but for to bestow them unto the honouring of God and Christ, and edifying of the congregation, which is the body of Christ.*

*The causes that moved me to translate, I thought better that others should imagine, than that I should rehearse them. Moreover, I supposed it superfluous; for who is so blind to ask, why light should be showed to them that walk in darkness, where they cannot but stumble, and where to stumble is the danger of eternal damnation; either so despiteful that he could envy any man (I speak not his brother) so necessary a thing; or so bedlam mad as to affirm that good is the natural cause of evil, and darkness to proceed out of light, and that lying should be grounded in truth and verity; and not rather clean contrary, that light destroyeth darkness, and verity reproveth all manner (of) lying.*

*After it had pleased God to put in my mind, and also to give me grace to translate this fore-rehearsed (before-mentioned) New Testament into our English tongue, howsoever we have done it, I supposed it very necessary to put you in remembrance of certain points.* *Tyndale* (A.D. 1525).

**BIBLE—Value of the.**

The most learned, acute, and diligent student cannot, in the longest life, obtain an entire knowledge of this one volume. The more deeply he works the mine, the richer and more abundant he finds the ore; new light continually beams from this source of heavenly knowledge, to direct the conduct, and illustrate the work of God and the ways of men; and he will at least leave the world, confessing that the more he studied the Scriptures the fuller conviction he had of his *own ignorance*, and of *their inestimable value.* *Sir Walter Scott.*

**GOD—Adoration of.**

While earthly objects are exhausted by familiarity, the thought of God becomes to the devout man continually brighter, richer, vaster; derives fresh lustre from all that he observes of Nature and Providence, and attracts to itself all the glories of the universe. The devout man, especially in moments of strong religious sensibility, feels distinctly that he has found the true happiness of man. He has found a Being for his veneration and love, whose character is inexhaustible, who, after ages shall have passed, will still be uncomprehended in the extent of his perfections, and will still communicate to the pure mind stronger proofs of His excellence, and more intimate signs of His approval. *Channing.*

**GOD—All in all.**

It is a poor philosophy and a narrow religion, which does not recognise God as all in all. Every moment of our lives we breathe, stand, or move in the temple of the Most High; for the whole universe is that temple. Wherever we go, the testimony to His power, the impress of His hand, are there. Ask of the bright worlds around us, as they roll in the everlasting harmony of their circles; and they shall tell you of Him, whose power launched them on their courses. Ask of the mountains, that lift their heads among and above the clouds; and the bleak summit of one shall seem to call aloud to the snow-clad top of another, in proclaiming their testimony to the Agency which has laid their deep foundations. Ask of ocean's waters; and the roar of their boundless waves shall chant from shore to shore a hymn of ascription to that Being, who hath said, "Hitherto shall ye come and no further." Ask of the rivers; and, as they roll onward to the sea, do they not bear along their ceaseless tribute to the ever-working Energy, which struck open their fountains and poured them down through the valleys? Ask of every region of the earth, from the burning equator to the icy pole, from the rock-bound coast to the plain covered with its luxuriant vegetation; and you will find on them *all* the record of the Creator's presence. Ask of the countless tribes of plants and animals; and shall they not testify to the action of the great Source of Life? Yes, from every portion, from every department of Nature, comes the same voice: everywhere we hear Thy name, O God; everywhere we see Thy love. Creation, in all its length and breadth, in all its depth and height, is the manifestation of Thy Spirit, and without Thee the world were dark and dead. The universe is to us as the burning bush which the Hebrew leader saw: God is ever present in it, for it burns with His glory, and the ground on which we stand is always holy.

How then can we speak of that Presence as peculiarly in the sanctuary, which is abroad through all space and time? *Francis.*

**GOD—the Fountain of Beatitude.**

Thou art the source and centre of all minds,
Their only point of rest, Eternal Word!
From Thee departing, they are lost, and rove
At random, without honour, hope, or peace.
For this is all that soothes the life of man,
His high endeavour, and his glad success,
His strength to suffer, and his will to serve.
But, O! thou bounteous Giver of all good,
Thou art, of all Thy gifts, Thyself the crown!
Give what Thou canst; without Thee we are poor,
And with Thee rich; take what Thou wilt away.

*Cowper.*

**GOD—An Indian's Conceptions of.**

Who is it that causeth the rain to rise in the high mountains, and to empty itself into the ocean? Who is it that causes to blow the loud winds of winter, and that calms them again in the summer? Who is it that rears up the shade of those lofty forests, and blasts them with the quick lightning at His pleasure? The same Being who gave to you a country on the other side of the waters, and gave ours to us; and by this title we will defend it.

*Quoted by Lord Erskine.*

**GOD—Confidence in.**

How calmly may we commit ourselves to the hands of Him who bears up the world—of Him who has created, and who provides for the joys even of insects, as carefully as if He were their father! *Richter.*

### GOD—Clemency of.

God! who is the Father of spirits, is the most tolerant. Man! who is the first of animals, is the most oppressive—yet he calls himself the shadow of the Almighty. Man becomes angry, and punishes for every little affront; God bears with all the insults and vices of man, who daily and hourly is employed in endeavouring to offend Him. Man pretends to admire the benign nature of the Deity; yet when he sees another imitate His clemency and good-nature, he calls him a fool. So much for man's consistency. *Jerdan.*

### GOD—the Creator.

HE HATH MADE THE EARTH BY HIS POWER, HE HATH ESTABLISHED THE WORLD BY HIS WISDOM, AND HATH STRETCHED OUT THE HEAVENS BY HIS DISCRETION. *Jeremiah.*

### GOD—Decrees of.

For men to judge of their condition by the decrees of God which are hid from us, and not by His word which is near us and in our hearts, is as if a man wandering in the wide sea, in a dark night when the heaven is all clouded about, should yet resolve to steer his course by the stars which he cannot see, but only guess at, and neglect the compass, which is at hand, and would afford him a much better and more certain direction. *Tillotson.*

### GOD—Duty to.

I cannot but take notice of the wonderful love of God to mankind, who, in order to encourage obedience to His laws, has annexed a present as well as a future reward to a good life; and has so interwoven our duty and happiness together, that, while we are discharging our obligations to the one, we are, at the same time, making the best provision for the other. *Melmoth.*

### GOD—Eternity of.

Even as darkness, self-impregned, brings forth
Creative light, and silence, speech; so beams,
Known through all ages, hope and help of man,
One God omnific, sole, original,
Wise wonder-working wielder of the whole,
Infinite, inconceivable, immense,
The midst without beginning, and the first
From the beginning, and of all Being last.

*Bailey.*

### GOD—in Everything.

One Spirit—His
Who wore the platted thorns with bleeding brows—
Rules universal nature. Not a flower
But shows some touch in freckle, streak, or stain,
Of His unrivall'd pencil. He inspires
Their balmy odours, and imparts their hues,
And bathes their eyes with nectar, and includes
In grains as countless as the sea-side sands,
The forms with which He sprinkles all the earth,
Happy who walks with Him; whom what he finds
Of flavour or of scent in fruit or flower,
Or what he views of beautiful or grand
In Nature, from the broad majestic oak,
To the green blade that twinkles in the sun,
Prompts with remembrance of a present God.

*Cowper.*

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There is no creature in the world, wherein we may not see enough to wonder at: for there is no worm of the earth, no spire of grass, no leaf, no twig, wherein we see not the footsteps of a Deity: the best visible creature is man; now what man is he that can make but an hair, or a straw, much less any sensitive creature, so as no less than an infinite power is seen in every object that presents itself to our eyes: if, therefore, we look only on the outside of these bodily substances, and we do not see God in everything, we are no better than brutish; make use merely of our sense without the least improvement of our faith or our reason. Contrary, then, to the opinion of those men, who hold that a wise man should admire nothing, I say that a truly wise and good man should admire everything, or rather that infiniteness of wisdom and omnipotence which shows itself in every visible object. *Bishop Hall.*

### GOD—Existence of.

And can there be who doubt there is a God,
And life eternal!—When the river flows,
Deny the fountain-head who will, the wave,
That, curling, murmurs farthest from its source,
That source attests. Show me some well-wrought work
Of matter or of mind; though you produce
No author, I conclude that such there was,
Or this had never been, and give him praise.
And why should sense demur? When the poor slave,
Doom'd by some tyrant's hard decree to starve,
Wakes in his dungeon, on his rocky bed,
From sleep, then wildly casts his eyes around,

As if in search of death, let him espy
In osier frame sweet herbage of the field
To greet his famish'd lip, and from the spring,
In earthen jar, the lucid draught to cheer
His parching tongue; will he not straight exclaim
That some kind hand hath oped his prison door,
And brought this bounty? Will he not invoke
A blessing on the donor as he tastes,
And feels the temperate tide of health return
To cool the heated vessels of his heart,
And pacify the fever in his brain?
Tell him 'twas chance:—but no;—you could not thus
Abuse his ear, nor wound his swelling soul
In presence of the angel Gratitude.

*Cowper.*

**GOD—Argument for the Existence of.**

There is no greater, at least no more palpable and convincing, argument of the existence of a Deity, than the admirable art and wisdom that discovers itself in the make and constitution, the order and disposition, the ends and uses, of all the parts and members of this stately fabric of heaven and earth. For if in the works of art, as for example a curious edifice or machine, counsel, design, and direction to an end, appearing in the whole frame, and in all the several pieces of it, do necessarily infer the being and operation of some intelligent architect or engineer, why shall not also in the works of nature, that grandeur and magnificence, that excellent contrivance for beauty, order, use, &c., which is observable in them, wherein they do as much transcend the effects of human art as infinite power and wisdom exceeds finite, infer the existence and efficiency of an Omnipotent and All-wise Creator? *Ray.*

**GOD—Nature demonstrating the Existence of.**

Little facts and circumstances, in the economy of Almighty God, have irresistible charms for me, and serve, like others more prominent, to show the perfect and beautiful manner in and for which everything has been created. In contemplating them, what a delightful lesson may we not learn! We may find in them the strongest testimonies of the truth of revelation, and the superintendence of an all-wise and benevolent Creator. It has been well said, that in the book of Nature is written in the plainest characters the existence of a God which Revelation takes for granted; of a God how full of contrivance! how fertile in expedients! how benevolent in his ends! At work everywhere, everywhere too with equal diligence; leaving nothing incomplete; finishing "the hinge in the wing of an insect," as perfectly as if it were all He had to do; unconfounded by the multiplicity of objects, undistracted by their dispersion, unwearied by their incessant demands on Him, fresh as on that day when the morning-stars first sang together, and all nature shouted for joy. *Jesse.*

**GOD—Necessity for the Existence of.**

Notwithstanding the consequences which may justly be dreaded by sinful and incorrigible beings, it is certainly of all things most desirable that there should be a God. Social order, and civil government, with all the sublime contemplations of religion, its dignifying effect, and powerful consolations, clearly depend on the grand principle, that there is a Being who made and who governs the universe. Such a Being must be infinitely worthy of the adoration of His rational creatures; He must have a claim on their implicit obedience; and to Him they must all be accountable. Here lie the foundations of human happiness, and particularly of that moral excellence, which even in this life approximates the rational creature to its highest attainable perfection; here too are the securities, and the only effective securities, of every constitution calculated to promote the present or the future felicities of man. *Duncan.*

**GOD—Creation Glorifies.**

Every created thing glorifies God in its place, by fulfilling His will, and the great purpose of His providence: but man alone can give tongue to every creature, and pronounce for all a general doxology. *Kirby.*

**GOD—Holiness of.**

Had not the covenant of mercy been infinitely holy, man could never have been saved. We stand in need of holiness as well as mercy. The grace of God in the child of God is infinitely more glorifying to God than the sun which shines by day, or the moon and stars which govern the night. Holiness raises man more highly above his fellow-men, than reason elevates him above the brute creation. The holiness of God reigns in hell, and ever will reign there: nor is the holiness of God less glorified in the condemnation of the wicked than in the salvation of the righteous. The law which executes the criminal is just as holy as the law which declares, "Thou shalt not kill." *Howels.*

**GOD—Immutability of.**

OF OLD HAST THOU LAID THE FOUNDATION OF THE EARTH: AND THE HEAVENS ARE THE WORK OF THY HANDS. THEY SHALL PERISH, BUT THOU SHALT ENDURE: YEA, ALL OF THEM SHALL WAX OLD LIKE A GARMENT: AS A VESTURE SHALT THOU CHANGE THEM, AND THEY SHALL BE CHANGED: BUT THOU ART THE SAME, AND THY YEARS SHALL HAVE NO END. *David.*

**GOD—Majesty and Justice of.**

WITH GOD IS TERRIBLE MAJESTY. TOUCHING THE ALMIGHTY, WE CANNOT FIND HIM OUT: HE IS EXCELLENT IN POWER, AND IN JUDGMENT, AND IN PLENTY OF JUSTICE: HE WILL NOT AFFLICT. MEN DO THEREFORE FEAR HIM. *Job.*

**GOD—Kindness of.**

BECAUSE HE HATH SET HIS LOVE UPON ME, THEREFORE WILL I DELIVER HIM: I WILL SET HIM ON HIGH, BECAUSE HE HATH KNOWN MY NAME. HE SHALL CALL UPON ME, AND I WILL ANSWER HIM. I WILL BE WITH HIM IN TROUBLE; I WILL DELIVER HIM AND HONOUR HIM. WITH LONG LIFE WILL I SATISFY HIM AND SHEW HIM MY SALVATION. *David.*

**GOD—Living Without.**

The high and the low, the young and the old, the busy and the idle, alike shun acquaintance with God, as if His very name brought uneasiness, and disturbed our comfort and repose. If we mention God to the young, we too often seem to be troubling them with what they had rather forget in such early days: while the aged dislike to be reminded of their misfortune, that their time on earth is drawing near to an end. If we mention God to the gay and happy, we appear to be interfering with their pleasures. If we mention Him to the great and to the learned, they will intimate that such subjects belong rather to an humbler class and station. But the poor and laborious, on their part, refer us to those who have more information and more leisure. Thus a large portion of mankind, in all classes, strive to keep God out of their thoughts, and to live, so far as in them lies, without Him in the world. Yes, without Him, who, as the Apostle says, *is not far from any one of us; for in Him we live, and move, and have our being.* Why should they act so strangely and unreasonably, if they believed that acquaintance with God would give them peace. *Bishop Sumner.*

**GOD—the Creator of Light.**

AND GOD SAID, LET THERE BE LIGHT, AND THERE WAS LIGHT. *Moses.*

**GOD—Love of.**

It is the nature of every artificer to tender and esteem his own work; and if God should not love His creature, it would reflect some disparagement upon His workmanship, that He should make anything that He could not own. God's power never produces what His goodness cannot embrace. God oftentimes, in the same man, distinguishes between the sinner and the creature: as a creature, He can love him, while as a sinner He does afflict him. *South.*

**GOD—Celestial Love of.**

Celestial love, with the affections of good and truth, and the perceptions thence derived, and at the same time with the delights of these affections and the thoughts thence derived, may be compared to a tree with beautiful branches, leaves, and fruits; the life's love is that tree; the branches, with the leaves, are the affections of good and truth, with their perceptions; and the fruits are the delights of the affections, with their thoughts. *Swedenborg.*

**GOD—Universal Love of.**

Canst thou believe the vast eternal mind
Was e'er to Syrts and Libyan sands confined?
That He would choose this waste, this barren ground,
To teach the thin inhabitants around,
And leave His truth in wilds and deserts drown'd?
*Rowe.*

There is an Eye that never sleeps
Beneath the wing of night;
There is an Ear that never shuts
When sink the beams of light.
There is an Arm that never tires
When human strength gives way;
There is a Love that never fails
When earthly loves decay.
That Eye is fix'd on seraph throngs;
That Ear is fill'd with angels' songs;
That Arm upholds the worlds on high;
That Love is throned beyond the sky.

*Heber.*

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The perfect love of God knoweth no difference between the poor and the rich. *Pacuvius.*

**GOD—Blessedness of Loving.**

Unto them that love him, God causeth all things to work for the best. So that with Him, by the heavenly light of steadfast faith, they see life even in death; with Him, even in heaviness and sorrow, they fail not of joy and comfort; with Him even in poverty, affliction, and trouble, they neither perish, nor are forsaken.

*Coverdale.*

**GOD—Beauty of the Name of.**

There is a beauty in the name appropriated by the Saxon nations to the Deity, unequalled, except by His most venerated Hebrew appellation. They called Him "GOD," which is literally "THE GOOD." The same word signifying the Deity, and His most endearing quality. *Turner.*

**GOD—Omnipotence of.**

Who guides below, and rules above:
The great Disposer, and the mighty King:
Than He none greater, next Him none,
That can be, is, or was:
Supreme, He singly fills the throne.

*Horace.*

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Power is that glorious attribute of God Almighty, which furnishes the rest of His perfections. 'Tis His omnipotence that makes His wisdom and goodness effectual, and succeed to the length of His will. Thus, His decrees are immutable, and His counsels stand; this secures His prerogative, and guards the sovereignty of His being; 'twas His power which made His ideas fruitful, and struck the world out of His thought. 'Twas this which answered the model of the creation, gave birth to time and nature, and brought them forth at His first call. thus, He spake the word, and they were made; He commanded, and they were created. 'Tis the divine power which is the basis of all things; which continues the vigour of the second causes, and keeps the sun and moon in repair. This holds everything constant to appointment, and true to the first plan; the revolutions of the seasons, the support of animals, the perpetuity of species, is carried on and maintained. Without this, things would soon run riot, and ramble out of distinction; the succours of life would be cut off, and nature drop into decay. Omniscience and goodness without a correspondent power would be strangely short of satisfaction; to know everything without being able to supply defects, and remedy disorders, must prove an unpleasant speculation; to see so many noble schemes languish in the mind and prove abortive; to see the most consummate wisdom, the most generous temper, fettered and disarmed, must be a grievance; but when omnipotence comes into the notion, the grandeur is perfect and the pleasure entire. *Jeremy Collier.*

**GOD—Omnipresence of.**

O LORD, THOU HAST SEARCHED ME, AND KNOWN ME. THOU KNOWEST MY DOWNSITTING AND MINE UPRISING, THOU UNDERSTANDEST MY THOUGHT AFAR OFF. THOU COMPASSEST MY PATH AND MY LYING DOWN, AND ART ACQUAINTED WITH ALL MY WAYS. FOR THERE IS NOT A WORD IN MY TONGUE, BUT LO, O LORD, THOU KNOWEST IT ALTOGETHER. WHITHER SHALL I GO FROM THY SPIRIT? OR WHITHER SHALL I FLEE FROM THY PRESENCE? IF I ASCEND UP INTO HEAVEN, THOU ART THERE: IF I MAKE MY BED IN HELL, BEHOLD THOU ART THERE. IF I TAKE THE WINGS OF THE MORNING, AND DWELL IN THE UTTERMOST PARTS OF THE SEA; EVEN THERE SHALL THY HAND LEAD ME, AND THY RIGHT HAND SHALL HOLD ME. IF I SAY, SURELY THE DARKNESS SHALL COVER ME; EVEN THE NIGHT SHALL BE LIGHT ABOUT ME. YEA, THE DARKNESS HIDETH NOT FROM THEE; BUT THE NIGHT SHINETH AS THE DAY: THE DARKNESS AND THE LIGHT ARE BOTH ALIKE TO THEE. *David.*

What can 'scape the eye
Of God, all-seeing, or deceive His heart
Omniscient!

*Milton.*

God is everywhere! the God who framed
Mankind to be one mighty family,
Himself our Father, and the world our home.

*Coleridge.*

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What would you say, if wherever you turned, whatever you were doing, whatever thinking, whether in public or private, with a confidential friend, telling your secrets, or alone planning them,—if, I say, you saw an eye constantly fixed on you, from whose watching, though you strove ever so much, you could never escape; and even if you closed your own eye to avoid, you still fancied that to get rid of it was impossible,—that it could perceive your every thought? The supposition is awful enough. There *is* such an Eye, though the business and struggles of the world too often prevent us from considering this awful truth. In crowds we are too much interrupted, in the pursuit of self-interest we are too much perverted, in camps we are struggling for life and death, in courts we see none but the eye of a human sovereign; nevertheless, the Divine eye is always upon us, and when we least think of it, is noting all, and, whatever we may think of it, will remember all.

*De Vere.*

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There is something in the thought of being surrounded, even upon earth, by the Majesty on high, that gives a peculiar elevation and serenity of soul. To be assured in the loneliest hour of unknown or neglected sorrow, that every sigh ascends to the eternal Throne, and every secret prayer can be heard in heaven; to feel that, in every act of conscious rectitude, the heart can appeal, amidst all the contradictions of sinners, to One who seeth not as man seeth, produces a peace which the world can never give. Feeling itself, like Enoch walking with God, the heart perceives a spirituality and purity in every joy, a mercy and a balm in every sorrow, and, exalted above the intrusions of an intermeddling world, has its "conversation in heaven." *Mathew.*

**GOD—Omniscience of.**

Though all the doors are sure, and all our servants
As sure bound with their sleeps, yet there is One
That wakes above, whose eye no sleep can bind.
He sees through doors, and darkness, and our thoughts;
And therefore, as we should avoid with fear,
To think amiss ourselves before His search,
So should we be as curious to shun
All cause that others think not ill of us.

*Chapman.*

**GOD—Presence of.**

At whose sight all the stars
Hide their diminish'd heads.

*Milton.*

**GOD—Loving Presence of.**

God is the light which, never seen itself, makes all things visible, and clothes itself in colours. Thine eye feels not its ray, but thine heart feels its warmth. *Richter.*

**GOD—Protection of.**

THE ANGEL OF THE LORD ENCAMPETH ROUND ABOUT THEM THAT FEAR HIM, AND DELIVERETH THEM. *David.*

**GOD—Providence of.**

Must not the conduct of a parent seem very unaccountable to a child when its inclinations are thwarted; when it is put to learn letters; when it is obliged to swallow bitter physic; to part with what it likes, and to suffer, and do, and see many things done, contrary to its own judgment? Will it not, therefore, follow from hence, by a parity of reason, that the little child *man*, when it takes upon itself to judge of parental providence—a thing of yesterday to criticise the economy of the *Ancient of Days*—will it not follow, I say, that such a judge of such matters must be apt to make very erroneous judgments, esteeming those things in themselves unaccountable which he cannot account for; and concluding of some things, from an appearance of arbitrary carriage towards him, which is suited to his infancy and ignorance, that they are in themselves capricious or absurd, and cannot proceed from a wise, just, and benevolent God? *Berkeley.*

**GOD—Belief in the Superintendence of.**

When any one acknowledges a moral governor of the world; perceives that domestic and social relations are perpetually operating, and seem intended to operate, to retain and direct men in the path of duty; and feels that

the voice of conscience, the peace of heart which results from a course of virtue, and the consolations of devotion, are ever ready to assume their office, as our guides and aids in the conduct of all our actions;—he will probably be willing to acknowledge also that the means of a moral government of each individual are not wanting: and will no longer be oppressed or disturbed by the apprehension that the superintendence of the world may be too difficult for its Ruler, and that any of His subjects and servants may be overlooked. He will no more fear that the moral than that the physical laws of God's creation should be forgotten in any particular case: and as he knows that every sparrow which falls to the ground contains in its structure innumerable marks of the Divine care and kindness, he will be persuaded that every man, however apparently humble and insignificant, will have his moral being dealt with according to the laws of God's wisdom and love; will be enlightened, supported, and raised, if he use the appointed means which God's administration of the world of moral light and good offers to his use.

*Whewell.*

**GOD—Necessity for the Superintendence of.**

Our existence is dependent on a succession of changes, which are taking place at every moment in ourselves, over which we have no power whatever, but of which, each one involves the necessity of the existence, and the superintending power, of the Deity. The existence of the whole material universe is of the same nature. Now, each of these changes is, with infinite skill, adapted to the relative conditions of all the beings whom they affect, and they are subjected to laws, which are most evident expressions of Almighty power, of unsearchable wisdom, and exhaustless goodness. Now, were we merely intellectual beings, it would not be possible for us to consider anything more than these laws themselves; but, inasmuch as we are intellectual and also *moral* beings, we are capable not only of considering the laws, but also the attributes, of the Creator from whom such laws are the emanations. As everything which we can know teaches a lesson concerning God; if we connect that lesson with everything we learn, everything will be resplendent with the attributes of Deity. By using, in this manner, the knowledge which is everywhere spread before us, we shall habitually cultivate a devout temper of mind. Thus, "the heavens will declare unto us the glory of God, and the firmament will show His handy work;" thus, "day unto day will utter speech, and night unto night show forth *knowledge of Him.*" *Wayland.*

**GOD—Supremacy of.**

THINE, O LORD, IS THE GREATNESS, AND THE POWER, AND THE GLORY, AND THE VICTORY, AND THE MAJESTY: FOR ALL THAT IS IN THE HEAVEN AND IN THE EARTH, IS THINE; THINE IS THE KINGDOM, O LORD, AND THOU ART EXALTED AS HEAD ABOVE ALL. *David.*

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THOU, EVEN THOU, ART LORD ALONE; THOU HAST MADE HEAVEN, THE HEAVEN OF HEAVENS WITH ALL THEIR HOST, THE EARTH AND ALL THINGS THAT ARE THEREIN, THE SEAS AND ALL THAT IS THEREIN, AND THOU PRESERVEST THEM ALL.

*Nehemiah.*

**GOD—Will of.**

I cannot tell by what logic we call a toad, a bear, and an elephant, ugly, they being created in those outward shapes and figures which best express the actions of their inward forms, and having past that general visitation of God, who saw that all that He had made was good, that is, conformable to His will, which abhors deformity, and is the rule of order and beauty. *Sir Thomas Brown.*

**GOD—Perfection of the Works of.**

What an immense workman is God! in miniature as well as in the great. With the one hand, perhaps, He is making a ring of one hundred thousand miles in diameter, to revolve round a planet like Saturn, and with the other is forming a tooth in the ray of the feather of a humming-bird, or a point in the claw of the foot of a microscopic insect. When He works in miniature, every thing is gilded, polished, and perfect, but whatever is made by human art, as a needle, &c., when viewed by a microscope, appears rough, and coarse, and bungling.

*Bishop Law.*

**GOD—Worship of.**

God is the source and fountain of love, and which may be divided into three parts—the receiving from Him, the conforming to Him, and the reposing and trusting in Him. *Burton.*

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It were better to have no opinion of God at all, than such an opinion as is unworthy of Him; for the one is unbelief, and the other is contumely; and certainly superstition is the reproach of the Deity. *Bacon.*

**CHRIST—Divine Attributes of.**

Christ is a rare jewel, but men know not His value; a sun which ever shines, but men perceive not His brightness, nor walk in His light. He is a garden full of sweets, a hive full of honey, a sun without a spot, a star ever bright, a fountain ever full, a brook which ever flows, a rose which ever blooms, a foundation which never yields, a guide who never errs, a friend who never forsakes. No mind can fully grasp His glory; His beauty, His worth, His importance, no tongue can fully declare. He is the source of all good, the fountain of every excellency, the mirror of perfection, the light of heaven, the wonder of earth, time's masterpiece, and eternity's glory; the sun of bliss, the way of life, and life's fair way. "He is altogether lovely," says the saint; a morning without clouds, a day without night, a rose without a thorn; His lips drop like the honeycomb, His eyes beam tenderness, His heart gushes love. The Christian is fed by His hands, carried in His heart, supported by His arm, nursed in His bosom, guided by His eye, instructed by His lips, warmed by His love; His wounds are his life, His smile the light of his path, the health of his soul, his rest and heaven below. *Balfern.*

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In Him, the self-existent and infinite mind, the Christian beholds unceasingly an object of boundless sublimity, grandeur, beauty, and loveliness, commanding by the disclosure of His character, and exhausting all finite admiration, complacency, love, and praise, expanding every view, refining every affection, and ennobling every attribute. *Dwight.*

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HIS NAME SHALL BE CALLED WONDERFUL, COUNSELLOR, THE MIGHTY GOD, THE EVERLASTING FATHER, THE PRINCE OF PEACE. *Isaiah.*

**CHRIST—Benevolent Character of.**

In the beautiful character of the blessed Jesus there was not a more striking feature than a certain sensibility, which disposed Him to take part in every one's affliction to which he was a witness, and to be ready to afford it a miraculous relief. He was apt to be particularly touched by instances of domestic distress, in which the suffering arises from those feelings of friendship, growing out of natural affection and habitual endearment, which constitute the perfection of man as a social creature, and distinguish the society of the humankind from the instinctive herdings of the lower animals. *Bishop Horsley.*

**CHRIST—Divinity of.**

IN HIM DWELLETH ALL THE FULNESS OF THE GODHEAD BODILY. *St. Paul.*

**CHRIST—Fidelity to.**

We indeed may not be called upon to make any very difficult sacrifices on account of our religion, or to undergo any extremity of labour, or to incur any signal dangers in that behalf. Yet the faithful Christian will always find occasions in which he may testify his fidelity to Christ, by labouring to instruct the ignorant, and by administering assistance and comfort to his afflicted brethren. And he who engages in these works and labours of love, provided he engage in them with Christian prudence as well as Christian benevolence, is manifesting thereby a laudable attachment to Christian faith. *Bishop Mant.*

**CHRIST—Gentleness of.**

The best of men
That e'er wore earth about him was a sufferer,
A soft, meek, patient, humble, tranquil spirit;
The first true gentleman that ever breathed.

*Decker.*

**CHRIST—and Godhead.**

The moon, a softer but not less beautiful object than the sun, returns and communicates to mankind the light of the sun, in a gentle and delightful manner, exactly suited to the strength of the human eye; an illustrious and most beautiful emblem, in this and several other respects, of the divine Redeemer of mankind; who, softening the splendour of the Godhead, brings it to the eye of the understanding, in a manner fitted to the strength of the mind, so that, without being overwhelmed or distressed, it can thus behold "the light of the knowledge of the glory of God in the face of Jesus Christ." *Dwight.*

**CHRIST—Benign Influence of.**

He walked in Judea eighteen hundred years ago; His sphere melody, flowing in wild native tones, took captive the ravished souls of men, and, being of a truth sphere melody, still flows and sounds, though now with thousand-fold accompaniments and rich symphonies, through all our hearts, and modulates and divinely leads them. *Carlyle.*

**CHRIST—Life of.**

I find the life of Christ made up of two parts; a part I can sympathize with as a man, and a part on which I am to gaze; a beam sent down from heaven which I can see and love, and another beam shot into the infinite that I cannot comprehend. *Barr.*

*** CHRIST—Every instance of Love to, is a case of reconciled affection.**

"How should a Jew, the particulars of whose history are better attested than that of any of his contemporaries, —how should he alone, the son of a carpenter, give out all at once that he was God, the Creator of all things? He arrogates to himself the highest adoration. He constructs his worship with his own hands, not with stones but with men. You are amazed at the conquests of Alexander. But here is a conqueror who appropriates to his own advantage, who incorporates with himself, not a nation, but the human race. Wonderful! the human soul with all its faculties becomes blended with the existence of Christ. And how? By a prodigy surpassing all other prodigies, he seeks the love of men, the most difficult thing in the world to obtain; he seeks what a wise man would fain have from a few friends, a father from his children, a wife from a husband, a brother from a brother,—in a word, the heart; this he seeks, this he absolutely requires, and he gains his object. Hence I infer his divinity. Alexander, Cæsar, Hannibal, Louis XIV., with all their genius, failed here. They conquered the world, and had not a friend.

"Christ speaks, and at once generations become his by stricter, closer ties than those of blood, by the most sacred, most indissoluble of all unions. He lights up the flame of a love which consumes self-love, which prevails over every other love.

"The founders of other religions never conceived of this mystical love, which is the essence of Christianity, and is beautifully called charity. Hence it is that they have struck upon a rock. In every attempt to effect this thing, namely, *to make himself beloved*, man deeply feels his own impotence. So that Christ's greatest miracle undoubtedly is the reign of charity. All who sincerely believe in him taste this wonderful, supernatural, exalted love. The more I think of this, I admire it the more; and it convinces me absolutely of the divinity of Christ.

"I have inspired multitudes with such affection for me that they would die for me. God forbid that I should compare the soldier's enthusiasm with Christian charity, which are as unlike as their cause. But, after all, my presence was necessary,—the lightning of my eye, my voice, a word from me, then the sacred fire was kindled in their hearts. I do, indeed, possess the secret of this magical power which lifts the soul, but I could never impart it to any one; none of my generals ever learnt it from me; nor have I the secret of perpetuating my name and love for me in the hearts of men, and to effect these things without physical means.

"Now that I am at St. Helena, now that I am alone, chained to this rock, who fights and wins empires for me? Where are any to share my misfortune, any to think of me? Who bestirs himself for me in Europe? Who remains faithful to me? where are my friends? Yes, two or three of you, who are immortalized by this fidelity, ye share, ye alleviate my exile. Such is the fate of great men. So it was with Cæsar and Alexander, and I too am forgotten; and the name of a conqueror and an emperor is a college theme: our exploits are tasks given to pupils by their tutor, who sits in judgment upon us, awarding us censure or praise. Such is soon to be the fate of the great Napoleon. What a wide abyss between my deep misery and the eternal kingdom of Christ, which is proclaimed, loved, adored, and which is extended over all the earth! Is this death? is it not life rather? The death of Christ is the death of a God." *Napoleon Bonaparte.**

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* I insert this extract as it is beautifully expressed; I have, however, no proofs of its authenticity beyond the statement of Mr. Nehemiah Adams, D.D., who gave it as here quoted in a sermon preached before the American Board of Commissioners for Foreign Missions, September, 1855, on the authority of Dr. G. de Felice, Professor in the Theological Seminary at Montauban, France, in a letter to the 'New York Observer,' April 16, 1842.

I would gladly believe its verity, but I am afraid what Lamartine says, in his 'Histoire de la Restauration,' of the Captivity of St. Helena is too true:—

"That monologue of six years, which he addressed to the world from the summit of his rock, and the most trivial words of which were registered by his courtiers to be transmitted to his myrmidons as the gospel of party, was nothing more than a long diplomatic note, void of good faith, addressed to his partisans, and speaking in turns the language of all the factions that he wished to nourish with his memory, instead of being the disinterested, sincere, and religious effusion of a soul which bequeaths with its greatness, its failings, its truth, and its repentance to the world."

Forsyth, in his 'Correspondence of Sir Hudson Lowe,' concludes with an able résumé of the character of Napoleon, and in the following words reminds us of a truth that certain books recently published would strive to ignore:—

"Can we, then, be so infatuated with hero-worship, so dazzled by the splendour of intellectual gifts, as to allow ourselves to treat gently and speak lightly of this contempt of veracity, this disdain of the first and simplest requirement of the moral law? No more pernicious lesson can be taught than the doctrine that success, which elevates a man to the pinnacle of power, absolves him from the obligation to observe the imperishable distinction between right and wrong. And we do in effect teach that doctrine when we forbear to censure in Napoleon Bonaparte a want of truth, which we should condemn in another as a meanness and a disgrace."

*** CHRIST—the Person of.**

AS MANY WERE ASTONISHED AT THEE; HIS VISAGE WAS SO MARRED MORE THAN ANY MAN, AND HIS FORM MORE THAN THE SONS OF MEN. *Isaiah*, chap. lii. 14.

. . . HE HATH NO FORM NOR COMELINESS; AND WHEN WE SHALL SEE HIM, [THERE IS] NO BEAUTY THAT WE SHOULD DESIRE HIM. HE IS DESPISED AND REJECTED OF MEN; A MAN OF SORROWS AND ACQUAINTED WITH GRIEF.
*Isaiah*, chap. liii. 3, 4.

FOR VERILY HE TOOK NOT ON [HIM THE NATURE OF] ANGELS; BUT HE TOOK ON [HIM] THE SEED OF ABRAHAM.
FOR IN THAT HE HIMSELF HATH SUFFERED BEING TEMPTED, HE IS ABLE TO SUCCOUR THEM THAT ARE TEMPTED.
*Hebrews*, chap. ii. 16, 18.

**CHRIST—always the Same.**

JESUS CHRIST THE SAME YESTERDAY, TO-DAY, AND FOR EVER. *St. Paul.*

**CHRISTIAN—Blessedness of being a.**

I have known what the enjoyments and advantages of this life are, and what the more refined pleasures which learning and intellectual power can bestow; and with all the experience that more than threescore years can give, I, now on the eve of my departure, declare to you (and earnestly pray that you may hereafter live and act on the conviction) that health is a great blessing—competence obtained by honourable industry a great blessing—and a great blessing it is to have kind, faithful, and loving friends and relatives; but, that the greatest of all blessings, as it is the most ennobling of all privileges, is to be indeed a Christian. *Coleridge.*

**CHRISTIAN—not to be Despised.**

However the world may affect to despise the genuine Christian, it is beyond their power; they feel too sensibly the necessity of attaining that very state of feeling and disposition which is displayed in such a character, to entertain in their heart any mean or degrading opinion of the character which they apparently undervalue. Every thought which it wrung from their conscience by its unwelcome intrusion upon their contemplation, rises in judgment against their indifference—God has not permitted them to despise a true Christian: they may pass him by with a haughty and supercilious coldness; they may deride him with a taunting and sarcastic irony; but the spirit of the proudest man that ever lived will bend before the grandeur of a Christian's humility. You are at once awed, and you recoil upon your own conscience when you meet with one whose feelings are purified by the Gospel. The light of a Christian's soul, when it shines into the dark den of a worldly heart, startles and alarms the gloomy passions that are brooding within. Is this contempt? No: but all the virulence which is excited by the Christian graces can be resolved into envy, the feeling of devils when they think on the pure happiness of angels—and, to complete their confusion, what is at that moment the feeling in the Christian's heart? Pity, most unfeigned pity! *Wolfe.*

**CHRISTIAN—Gold in the Ore.**

A Christian in this world is but gold in the ore; at death, the pure gold is melted out and separated, and the dross cast away and consumed. *Flavel.*

**CHRISTIAN—Proofs of a.**

He that can apprehend and consider vice with all her baits and seeming pleasures, and yet abstain, and yet distinguish, and yet prefer that which is truly better, he is the true wayfaring Christian. I cannot praise a fugitive and cloistered virtue unexercised, and unbreathed, that never sallies out and sees her adversary, but slinks out of the race where that immortal garland is to be run for, not without dust and heat. *Milton.*

**CHRISTIAN—Virtues of a.**

If these be Christian virtues, I am a Christian;
The faith that can inspire this gen'rous change
Must be divine—and glows with all its God!
Friendship and constancy, and right and pity,
All these are lessons I had learnt before;
But this unnatural grandeur of the soul
Is more than mortal, and outreaches virtues;
It draws, it charms, it binds me to be Christian.
*Hill.*

**CHRISTIAN—Wit of a.**

A Christian's wit is inoffensive light,
A beam that aids, but never grieves the sight;
Vig'rous in age as in the flush of youth,
'Tis always active on the side of truth;
Temp'rance and peace ensure its healthful state,
And make it brightest at its latest date.

*Cowper.*

**CHRISTIANS—Nominal.**

Many there are who, while they bear the name of Christians, are totally unacquainted with the power of their divine religion. But for *their* crimes the Gospel is in no wise answerable. Christianity is with them a geographical, not a descriptive, appellation. *Faber.*

**CHRISTIAN SOLDIER—Faith of a.**

It is more to the honour of a Christian soldier by faith to overcome the world, than by a monastical vow to retreat from it; and more for the honour of Christ, to serve Him in a city, than to serve Him in a cell.

*Matthew Henry.*

**CHRISTIANITY—without Ceremonial.**

Christianity has no ceremonial. It has forms, for forms are essential to order; but it disdains the folly of attempting to reinforce the religion of the heart by the antics of the mind. *Croly.*

**CHRISTIANITY—Difficulties of.**

Now you say, alas! Christianity is hard: I grant it; but gainful and happy. I contemn the difficulty, when I respect the advantage. The greatest labours that have answerable requitals, are less than the least that have no regard. Believe me, when I look to the reward, I would not have the work easier It is a good Master whom we serve, who not only pays, but gives; not after the proportion of our earnings, but of His own mercy.

*Bishop Hall.*

**CHRISTIANITY—Distinctions in.**

The main distinction between real Christianity and the system of the bulk of nominal Christians, chiefly consists in the different place which is assigned in the two schemes to the peculiar doctrines of the Gospel. These, in the scheme of nominal Christians, if admitted at all, appear but like the stars of the firmament to the ordinary eye. Those splendid luminaries draw forth, perhaps, occasionally, a transient expression of admiration when we behold their beauty, or hear of their distances, magnitudes, or properties; now and then, too, we are led, perhaps, to muse upon their possible uses; but, however curious as subjects of speculation, it must, after all, be confessed they twinkle to the common observer with a vain and "idle" lustre; and, except in the dreams of the astrologer, have no influence on human happiness, or any concern with the course and order of the world. But to the *real* Christian, on the contrary, *these peculiar doctrines constitute the centre to which he gravitates! the very sun of his system! the origin of all that is excellent and lovely! the source of light, and life, and motion, and genial warmth, and plastic energy!* Dim is the light of reason, and cold and comfortless our state while left to her unassisted guidance. Even the Old Testament itself, though a revelation from Heaven, shines but with feeble and scanty rays. But the blessed truths of the Gospel are now unveiled to *our* eyes, and *we* are called upon to behold and to enjoy "the light of the knowledge of the glory of God, in the face of Jesus Christ," in the full radiance of its meridian splendour. The words of Inspiration best express our highly-favoured state: "we all, with open face, beholding as in a glass the glory of the Lord, are changed into the same image, from glory to glory, even as by the Spirit of the Lord."

*Wilberforce.*

**CHRISTIANITY—Evidences of.**

As to the Christian religion, besides the strong evidence which we have for it, there is a balance in its favour from the number of great men who have been convinced of its truth after a serious consideration of the question. Grotius was an acute man, a lawyer, a man accustomed to examine evidence, and he was convinced. Grotius was not a recluse, but a man of the world, who certainly had no bias on the side of religion. Sir Isaac Newton set out an infidel, and came to be a very firm believer. *Johnson.*

**CHRISTIANITY—Gifts of.**

Ours is a religion jealous in its demands, but how infinitely prodigal in its gifts! It troubles you for an hour, it repays you by immortality. *Bulwer Lytton.*

**CHRISTIANITY—true to the Heart.**

Christianity, which is always true to the heart, knows no abstract virtues, but virtues resulting from our wants, and useful to all. *Chateaubriand.*

**CHRISTIANITY—Intent of.**

Christianity did not come from heaven to be the amusement of an idle hour, to be the food of mere imagination; to be "as a very lovely song of one that hath a pleasant voice, and playeth well upon an instrument." No; it is intended to be the guide, the guardian, the companion of all our hours: it is intended to be the food of our immortal spirits; it is intended to be the serious occupation of our whole existence. *Bishop Jebb.*

*** CHRISTIANITY—not the subject of Mathematical demonstration.**

Finzy said—"You do not know, perhaps, that I am in the service of the pasha, as professor of mathematics, and therefore I demand of you mathematical proofs of the truths of Christianity." I said, "Do you ever eat?" Finzy, "Yes." Dr. Wolff, "Why do you do so?" Finzy, "Hunger compels me." Dr. Wolff, "Can you prove that mathematically?" *Dr. Wolff, Missionary Journal.*

**CHRISTIANITY—Mission of.**

Christ appeared—the career of Paganism was checked, the fate of Judaism was sealed. A character and a religion were placed before the eyes of men hitherto inconceivable, in the beauty and philosophy of their nature. Unlike all other founders of a religious faith, Christ had *no selfishness, no desire of dominance;* and His system, unlike all other systems of worship, was bloodless, boundlessly beneficent, inexpressibly pure, and—most marvellous of all—went to break all bonds of body and soul, and to cast down every temporal and every spiritual tyranny. *William Howitt.*

**CHRISTIANITY—Divine Origin of.**

Christianity bears all the marks of a divine original: it came down from heaven, and its gracious purpose is to carry us up thither. Its author is God; it was foretold from the beginning, by prophecies, which grew clearer and brighter as they approached the period of their accomplishment. It was confirmed by miracles, which continued till the religion they illustrated was established. It was ratified by the blood of its author; its doctrines are pure, sublime, consistent; its precepts just and holy; its worship is spiritual; its service reasonable, and rendered practicable by the offers of divine aid to human weakness. It is sanctioned by the promise of eternal happiness to the faithful, and the threat of everlasting misery to the disobedient. It had no collusion with power, for power sought to crush it; it could not be in any league with the world, for it set out by declaring itself the enemy of the world; it reprobated its maxims, it showed the vanity of its glories, the danger of its riches, the emptiness of its pleasures. This religion does not consist in external conformity to practices which, though right in themselves, may be adopted from human motives, and to answer secular purposes; it is not a religion of forms, and modes, and decencies; it is being transformed into the image of God; it is being like-minded with Christ; it is considering Him as our sanctification, as well as our redemption; it is endeavouring to live to Him here, that we may live with Him hereafter. *Hannah More.*

**CHRISTIANITY—Perversion of.**

It may be well said of many who would be displeased with you if you did not call them Christians, that had some of the ancient heathen sages lived to the present day, to see their abominations and vices, they would have despised that faith which produced no better works.

Alas! how has the social spirit of Christianity been perverted by fools at one time, and by knaves and bigots at another; by the self-tormentors of the cell, and the all-tormentors of the conclave. *Colton.*

**CHRISTIANITY—Teaching of.**

Christianity forbids no necessary occupations, no reasonable indulgences, no innocent relaxations. It allows us to use the world, provided we do not abuse it. It does not spread before us a delicious banquet, and then come with a "touch not, taste not, handle not." All it requires is, that our liberty degenerate not into licentiousness, our amusements into dissipation, our industry into incessant toil, our carefulness into extreme anxiety and endless solicitude. So far from forbidding us to engage in business, it expressly commands us not to be slothful in it, and to labour with our hands for the things that be needful; it enjoins every one to abide in the calling wherein he

was called, and perform all the duties of it. It even stigmatizes those that provide not for their own, with telling them that they are worse than infidels. When it requires us "to be temperate in all things," it plainly tells us, that we *may* use *all* things temperately; when it directs us "to make our moderation known unto all men," this evidently implies, that within the bounds of moderation we may enjoy all the reasonable conveniences and comforts of the present life. *Bishop Porteus.*

**CHRISTIANITY—Treatment of.**

Servile and base and mercenary is the notion of Christian practice among the bulk of *nominal* Christians. They give no more than they *dare* not withhold: they abstain from nothing but what they *must* not practise. When you state to them the doubtful quality of any action, and the consequent obligation to desist from it, they reply to you in the very spirit of Shylock, "they cannot find it in the bond." In short, they know Christianity only as a system of restraint. She is despoiled of every liberal and generous principle: she is rendered almost unfit for the social intercourses of life, and is only suited to the gloomy walls of a cloister, in which they would confine her. *Wilberforce.*

**CHRISTIANITY—Value of.**

We live in the midst of blessings, till we are utterly insensible of their greatness, and of the source from which they flow. We speak of our civilization, our arts, our freedom, our laws, *and forget entirely how large a share of all is due to Christianity.* Blot Christianity out of the page of man's history, and what would his laws have been? —what his civilization? Christianity is mixed up with our very being and our daily life, there is not a familiar object round us which does not wear its mark, not a being or a thing which does not wear a different aspect, because the light of Christian hope is on it, not a law which does not owe its truth and gentleness to Christianity, not a custom which cannot be traced in all its holy and healthful parts to the Gospel. *Rose.*

*** CHRISTIANITY—Vitality of.**

Waft, waft, ye winds, his story,
And you, ye waters, roll,
Till, like a sea of glory,
It spreads from pole to pole;
Till o'er our ransom'd nature
The Lamb for sinners slain,
Redeemer, King, Creator,
In bliss returns to reign.

*Heber.*

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